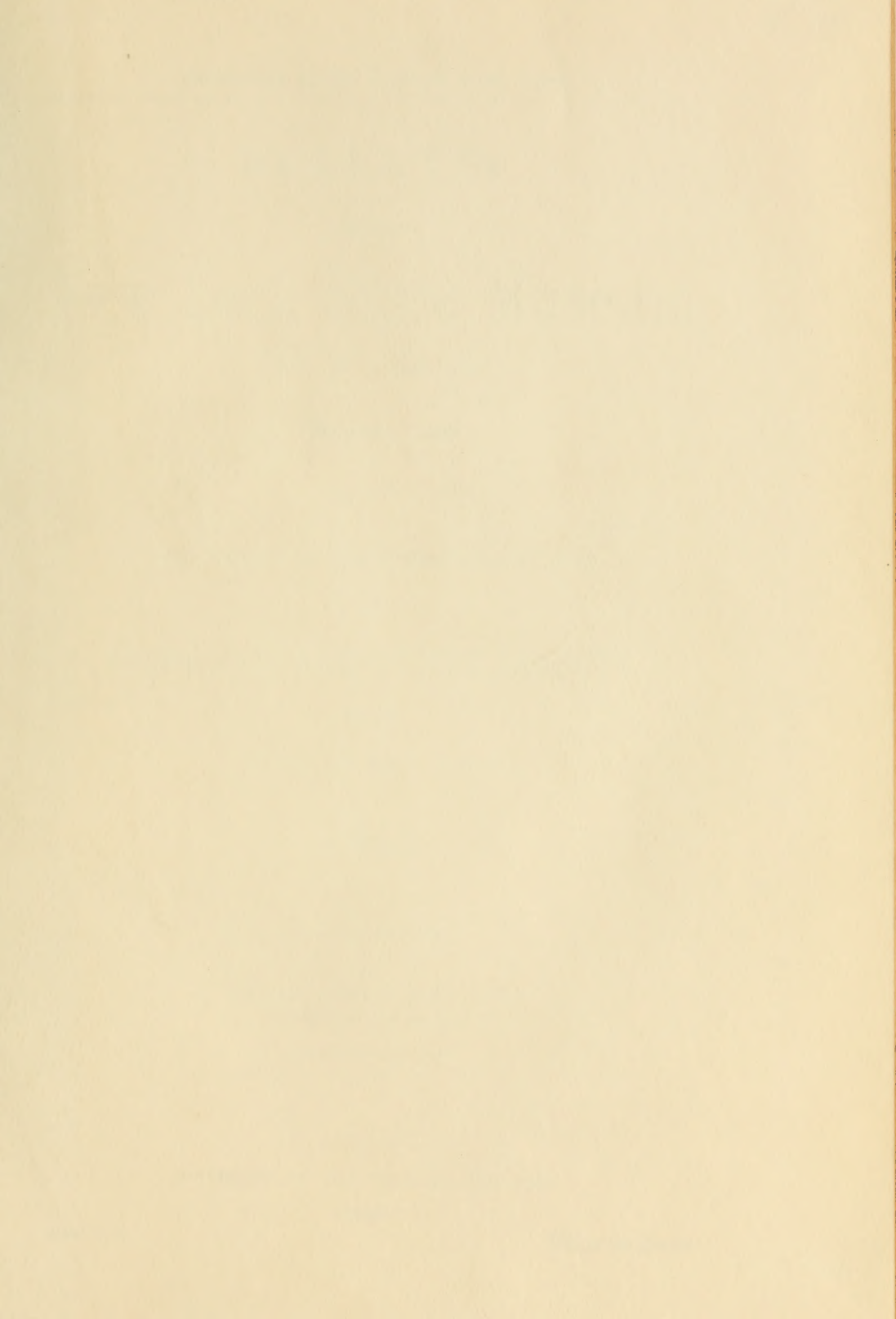


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University of the State of New York

BULLETIN

OF THE

New York State Museum

VOL. 5 No. 23

December 1898

14th Report of the state entomologist

ON

INJURIOUS AND OTHER INSECTS

OF THE

STATE OF NEW YORK

1898

BY

EPHRAIM PORTER FELT, D. Sc.

Acting State Entomologist

ALBANY

UNIVERSITY OF THE STATE OF NEW YORK

1898

University of the State of New York

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^a A general account and bibliography is given of each.

14TH REPORT
OF THE
STATE ENTOMOLOGIST
1898

OFFICE OF STATE ENTOMOLOGIST
Albany, October 15, 1898

To the Secretary of the University of the State of New York:

I have the honor of presenting herewith my report on the injurious and other insects of the state of New York, for the portion of the present year ending October 15, 1898.

General entomologic features. The year has been characterized by excessive damages to trees in both city and country. Reports have been received from many localities of widespread injuries by the tent caterpillars, *Clisiocampa americana* Fabr. and *C. disstria* Hübn. The white-marked tussock moth, *Notolophus leucostigma* Sm.-Abb., was reported as unusually destructive to shade trees in various parts of the state, while in Albany its injuries have been greater than for several years. A remarkable outbreak occurred at Schenectady, the light green larvae of *Xylina antennata* Walker appeared in such numbers that a large portion of the many soft maples in that city was defoliated. Such destructive work by this species has never been recorded, and is a striking example of what a comparatively harmless insect can do, provided the conditions are favorable. Another interesting feature was the presence of zebra caterpillars, *Mamestra picta* Harris, in such abundance on recently gathered timothy hay as to literally cover it. Hitherto, this pest has been regarded as an enemy to cabbage and related garden crops, more rarely attacking other plants. The leaves of many elms have been seriously injured by an unknown leaf miner. The cottony maple-tree scale, *Pulvinaria innumerabilis* Rathvon, has been extremely abundant and destructive throughout the state, affecting the soft maples most seriously. The destructive brown apricot scale of California, *Lecanium armeniacum* Craw, was discovered in Erie county on

grapevine. Its eradication was recommended, and it is believed that it has been effected.

Elm-leaf beetle. The widespread injuries for the last few years by the elm-leaf beetle along the Hudson river valley, induced the preparation of an illustrated museum bulletin (Museum bulletin 20) on this most pernicious insect, which was issued in the middle of July, at a time when the extremely destructive work of the insect was apparent to all. The demand for this bulletin indicates a general interest in the methods of controlling this species. In addition, a number of articles treating of this pest have been sent to local papers and addresses delivered in adjacent places at several meetings called for the special purpose of considering the best manner of subduing this insect. It is hoped that the agitation of this year will lead to more effective control another season.

San José scale. The recent law placing the inspection of all nursery stock in the state under the direction of the commissioner of agriculture, has emphasized the intimate relations that should continue to exist between this office and his department. While the law was designed primarily to prevent the spread of this scale insect, *Aspidiotus perniciosus* Comstock, it was so drawn as to include 'dangerously injurious insects,' and to the entomologist the commissioner gave the delicate task of determining what species came within the scope of the law. In addition, my opinion has been asked in regard to cases in which appeal from the decision of the inspector had been made to the commissioner of agriculture, and many examples of scale insects were submitted to me for determination. When it is stated, that in order to be positive in regard to the identity of a scale insect, in many cases the creature must first be treated with potassium hydrate and a microscopic preparation made, some idea of the time occupied by this work will be gained.

Office publications. In addition to the bulletin on the elm-leaf beetle, the early part of the year was largely occupied by the work incident to the publication and distribution of the late Dr Lintner's 12th report, for the year 1896, and preparation of his 13th report, for the year 1897, now in press. The prominent place among economic entomologists occupied by Dr Lintner, and the most excellent character of all his work, rendered it very desirable that his numerous publications should be made accessible to all, so far as possible. Therefore, in addition to a short notice of his life, a bibliography of his writings, giving a brief abstract, title, place and date of publication, and a general index of his 13 reports, based on the extended one in that for 1894, have been prepared as a supplement to this report, and will appear in a subsequent bulletin. As much of this work had to be done in the early summer, at a

time when field work could most profitably be undertaken, original investigation was necessarily somewhat limited.

Office work. The routine office work of the division during the past summer has been heavier than at any time since my connection with the office. Without attempting any radical innovations, it has been my aim to render services of the greatest practical value to the public. The numerous calls for information from all quarters indicate that my efforts have been greatly appreciated. The demand for press notices, mainly agricultural, has been greater than that recorded any previous year. Abstracts of my principal publications, 72 in number, are given in a subsequent portion of this report. The presentation in agricultural and other journals of reliable information regarding insects should be encouraged, as it brings the recommendations before farmers and others at a time when they are of the greatest value, which is not always true of bulletins and reports. Considerable attention has been paid to this branch of the work with most gratifying results. A large portion of these notices have appeared in the *Country gentleman*, one of the best agricultural weeklies, but in no case has preference been shown to any paper. Every request for information has received due attention. The correspondence has been unusually heavy. The number of letters received since January 1 is 748^a, and the number written is 1199. Most of the queries resulted from a general desire for information, though some were due to excessive ravages by tent caterpillars and other insects.

The work of the division has been greatly facilitated by the assignment to it of a junior clerk, Miss M. I. Bull, whose services, though she had no previous entomologic training, have been a great aid, relieving me of considerable clerical work and thus allowing time for more important duties. The purchase of a good field camera constitutes a valuable addition to the equipment of the office.

Collection of insects. The state collection of insects remains practically as it was at the beginning of the year, with additions as given later in this report. The pressing duties of the office during the past few years have prevented much desirable work being done on the collection. Since my connection with the University, a number of new boxes have been bought, most of the insects referred to their various families, and in a few instances, those of a family have received their generic and specific labels. A beginning has also been made on a biologic collection, something the late Dr Lintner had been laboring to bring about for years.

^a The death of Dr Lintner at the time the 12th report was issued, deterred many from acknowledging its receipt, thus reducing the number of letters received. The cards accompanying the reports were counted, as previously, hence the discrepancy between the letters received and written.

The accommodations provided for the collection are far from adequate. During the past 18 years a vast amount of material has been accumulating, and when properly worked up, will be found a mine of information. The state collection needs more room. At present, part is in wooden trays with glass tops and part in pasteboard boxes. A first class box or tray should be decided on and then the whole collection overhauled, classified and rendered accessible to the public. At present the specimens are threatened with injury on account of dampness, the result of a leaky roof, or they may be destroyed by museum pests, as none of the trays or boxes are as tight as they should be. The work on the biologic collection should be pushed, special attention being paid to the forms of economic importance. An exhibit of this character would prove a most important educational factor, and would be of the greatest practical value to all in the vicinity. If, in addition to this, some plan were devised whereby small biologic collections could be prepared and either temporarily lent to granges or other organizations interested in the advancement of applied science or placed on exhibition at farmers' institutes, fairs and other gatherings, specially if in charge of one competent to explain the salient points in the life history of the various forms, a moderate outlay would not only advance the agricultural interests of the state, but would also bring the office into closer touch with those whom it is designed to serve.

The private collection belonging to the late incumbent is still in the office and would be an invaluable addition to the state collection, containing, as it does, many rare and unique forms.

Division library. To obtain the best results, it is absolutely necessary to have a good library at hand. During his tenure of office, the late Dr Lintner depended for reference very largely on his private library, a collection of books and papers that has few, if any, equals, so far as economic entomology is concerned. Many of the books are rare, and several of the sets of serial publications are supplementary to those belonging to the state. If possible, it should be bought for this division.

J. A. Lintner. In the death of **Joseph Albert Lintner**, Ph. D., the state sustained a great loss and the science of economic entomology was called on to mourn a leader. It is hoped that the grand work begun by him 18 years ago will be carried on, and that the practical side of the science will ever be kept in mind.

Acknowledgments. At this time I wish to acknowledge the many favors and courtesies received at the hands of Dr L. O. Howard, chief of the division of entomology at Washington, and his associates. Every

request, either for the name of an insect or for further information regarding it, has been promptly honored. The advantage of such a central bureau, where a number of specialists are constantly working on certain orders or families, can be appreciated only by those who have some conception of the immense number of insects and of the utter impossibility of identification of all the varied forms by one person. In conclusion, I wish to express my appreciation of the opportunities afforded me by the regents during the past few months, and for the support that has been given my every effort to render this office of greater practical value.

Respectfully submitted

EPHRAIM PORTER FELT

Acting state entomologist

INJURIOUS INSECTS

BYTURUS UNICOLOR Say*Pale brown Byturus*

Ord. Coleoptera : Fam. Dermestidae

A number of examples of this small beetle were brought to me May 23, by Dr C. H. Peck, state botanist, with the information that from one to five or more were to be found in the opening buds of his raspberry plants. A little later he informed me that his bushes had been injured to a considerable extent by the work of this species. The attack is of considerable interest, as there is no record of its having proved injurious since 1870, when Dr Fitch noticed briefly the work of its larvae upon the fruit. Lack of record by no means indicates its absence; on the contrary it is more probable that considerable of the unknown injury to raspberry plants, indicated by failure to bear well, has been caused by the work of this insect.

Injuries and distribution. The beetles not only eat into the fruit buds of the plant, thereby destroying the berry at its inception, but, according to Dr Packard, may also eat long strips in the leaves. Dr Fitch states that the white larvae of the insect are very common on the fruit throughout the country, their presence rendering the berries unfit for food. The earliest injuries known are those in Massachusetts and New York in 1870, the former by the beetles to the leaves and fruit buds and the latter by the larvae to the fruit itself. In 1873, William Saunders reported this species as very destructive to the blossoms, presumably in the vicinity of Ottawa, Canada. At Lansing, Mich., much damage was inflicted on raspberry blossoms by this or a closely allied species in 1885, according to Prof. C. P. Gillette. The beetles were again destructive in Canada in 1887, appearing in numbers and doing considerable damage to the buds and flowers (Fletcher). In her 15th report for the year 1893, Miss Ormerod records serious and widespread injuries to raspberries in England by the closely allied *Byturus tomentosus*. The damage done in England may be taken as an indication of the injury that our American form may possibly inflict. Besides feeding on the raspberry, *B. unicolor* was observed by Prof. Webster eating out the blossom buds of a species of *Geum*, either *rivale* or *album*.

LeConte and Horn (see citation) state that but one species, obviously *B. unicolor*, occurs in the Atlantic district. The present record indicates that it is pretty well distributed over the eastern United States and extends north into Canada.

Description. The beetles are about $\frac{1}{7}$ inch long, subcylindric, and of a pale reddish brown color. With a lens, the dense, rather long, pale, tawny hairs covering the entire upper surface are easily distinguished; the vestiture of the under surface is shorter.

The larva has been described by Dr Fitch as follows:

When examined with a magnifying glass, these worms are found to be plump and cylindric, slightly tapered at each end, and nearly $\frac{1}{4}$ inch in length when fully grown. They are white, each segment having on the back a broad, pale, tawny yellow band occupying more than half its surface, and being also furnished with a few short, erect, whitish hairs. The mouth is darker, tawny yellow. On the breast are three pairs of legs, but none on the body back of these, except at the tip, which is prolonged into a single proleg of a short conic form, and blunt at its end; and on the apex of the last segment, above the base of the proleg, are two minute projecting points, appearing like two deep red dots.

Life history. The beetles occur on the raspberries the latter part of May, and in Massachusetts till after the middle of June, as stated by Dr Packard. The eggs are probably laid on the developing fruit, as is recorded by Miss Ormerod of the related *B. tomentosus*. The following notes on its life history are based on records by Dr Fitch. The larvae are usually found lying on the inner side of the cup or cavity in the berry. When full grown they drop to the ground or fall with the fruit and transform to pale, dull, yellowish pupae under leaves or other rubbish, where they remain till the following May. Miss Ormerod states that *B. tomentosus* pupates under the sheltering bark of the raspberry or in some similar place. It is possible that our species also pupates to some extent on the canes.

Remedies. The beetles can probably be controlled by spraying with an arsenite. Hand picking or beating them from the bushes into pans containing water and a little kerosene, has also been recommended. The latter will be more effective if done in the cooler part of the day, as the beetles will be less likely to take flight. There are no effective means of dealing with the larvae. If the insect becomes numerous in a patch, it might be advisable to burn all the trimmings and rubbish, in order to destroy as many of the hibernating individuals as possible.

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TRYPETA CANADENSIS Loew

Gooseberry fruit fly

Ord. Diptera: Fam. Trypetidae

The small maggot of the gooseberry midge, *Cecidomyia grossulariae* Fitch, has long been known to breed in currants and gooseberries, thus destroying the fruit. This insect and its destructive work was described

^a Volume and page references are separated by a colon, e. g. 3: 197 means volume 3, page 197.

and commented upon by Dr Fitch in 1854. It is only in later years, however, that the maggot of another species of fly was detected injuring the fruit of these plants in a very similar manner, and it is possible that its work in earlier years was confounded with that of the gooseberry midge.

Operations in New York state. The work of this insect was first brought to the notice of Dr Lintner by Mrs H. D. Graves, of Ausable Forks, N. Y., in May 1890, when the trouble was so serious in her locality that some neighbors destroyed their currant bushes on account of the numerous maggots infesting the fruit. Both the white and red varieties were attacked. Again, in 1894, Mr J. G. Collett, of Camden, N. Y., wrote that nearly all of his gooseberries fell off every year before they were fully matured, owing to the presence of 'a small white worm or maggot just under the skin.' This attack could be referred to no other than the above-named species. With such a record in the two places where this insect has established itself in this state, it bids fair to be as serious an enemy to the currant and gooseberry as is the closely related apple maggot, *Trypeta pomonella*, to the apple. Its injuries in other localities where it has been found are so great that it may well be classed as a dangerous insect pest.

Distribution. This insect has been recorded from but a few widely separated localities, and is most probably a native form. It was originally described from Maine or Canada. Prof. Gillette found it abundant in Colorado; it was sent to the U. S. Department of agriculture from West Ferndale, Wash.; it has been reported recently as abundant in that state and Dr Fletcher has long known of injuries to black currants in British Columbia by what is most probably this insect. In New York state it has been very abundant in two localities distant from each other and may be more generally distributed throughout the state than is supposed.

Life history. The following account of the life history and habits of this fly is a résumé of the detailed paper on it by Prof. Harvey (see citation), which should be consulted for farther information. The flies were first observed by him in nature about June 1, though punctures on the fruit at that time indicated an earlier appearance. There is but one generation annually. The imagoes were most abundant June 9-15, all having disappeared by the 25th. The eggs are deposited singly, the female requiring about five minutes for the insertion of each just beneath the skin of the fruit, where they may easily be seen a little to one side of

the nearly invisible puncture, which soon becomes surrounded by a brown areola. They are deposited most largely in the earliest berries to appear, i. e. those at the base of the bunch. After emerging from the egg, the young larva works its way along under the skin of the berry, usually leaving a trail, for perhaps a third or half of the circumference, and then in most cases enters one of the seeds. It soon becomes too large for its refuge and may then be found lying between the seeds and feeding upon them. Occasionally two or three larvae are found within a single berry. The injured seeds turn black and become cemented together. Later, the infested currants show a clouded appearance on the side, occasioned by the presence of the larva; soon that cheek turns red, becomes darker and finally black. The infested berries ripen early and drop, often before the larvae have matured, but occasionally the currants on the bushes show the exit hole cut by the matured larva in its escape to the ground. Many, however, remain in the fallen fruit for several days before emerging therefrom for pupation, some for over three weeks, though most of them forsake the berries within a week. The larvae pupate either in the soil or under some convenient shelter on the surface during the latter part of June or early in July, the fly appearing the following spring.

Remedies. About the only satisfactory methods of fighting this insect are the destruction of the infested fruit with the contained insect or killing it while still in the ground. The most practical method of controlling this species is, in most cases, to allow chickens to run among the bushes, as they will devour much of the infested fruit. If the ground is kept cultivated, and the fowls are allowed to scratch, many pupae will be destroyed in this manner. Another remedy that promises to be effective is spraying the ground under the bushes with kerosene emulsion after the insects have pupated. If this was done just before a rain, the emulsion would be washed into the soil and come in contact with the pupae. This treatment should be as fatal to this insect as it has proved in the case of white grubs in the soil.

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NOTOLOPHUS LEUCOSTIGMA Sm.—Abb.

The white-marked tussock moth

Ord. **Lepidoptera** : Fam. **Lymantriidae**

The destructiveness of this pest has been so marked and widespread in cities and towns, and inquiries for remedies so numerous, that in spite of the fact that it is, or should be, a well-known insect, it is deemed desirable to notice this species at some length. Though very injurious, it is controlled with comparative ease, and this should be kept before the public, even at the cost of some repetition.

Ravages in 1898. This insect has proved a serious pest in a number of cities within the state. In Albany, most of the horsechestnuts would have been completely defoliated had it not been for the spraying undertaken by the municipal authorities. As it was, a large number were seriously injured, owing to the late application of the poison or to inability to throw the spray to the tops of the larger trees. The leaves were nearly stripped from the lindens, and the numerous white egg clusters give promise of greater injury another year, unless protective measures are adopted. In parts of Troy this insect was even more destructive than in Albany. Reports of serious ravages have been received from other localities. Its cocoons were reported by Chester Young, nursery inspector for the state department of agriculture, as abundant on all kinds of trees at Woodside, L. I., which may well be regarded as an indication of extended injuries already sustained and a sign of worse to come. In Buffalo, this insect has become such a pest that the authorities have been stirred to action. A circular has been issued by the board of public works calling upon the citizens to collect and destroy the egg clusters, and giving directions for the same and also

for spraying in the spring. It is expected that this call will be supplemented by the city fighting the pest where it is impossible for land holders to accomplish the desired object.

Injuries to fruit trees. In earlier years this was regarded as a very serious enemy of the apple-tree in Ontario, for Rev. C. J. S. Bethune, writing in 1871, stated that it was a bad pest, and that in the western states it had defoliated some orchards and even attacked the fruit. In his second report, Dr Lintner records several instances of severe injuries to fruit trees by this species. Serious depredations have also been reported by Mr Lowe, entomologist of the agricultural experiment station at Geneva. In 1895 he received many complaints, specially from Yates and Ontario counties, the larvae not only devouring the foliage, but attacking the fruit. In the report of the station for that year, he writes that one fruit grower estimated the loss on his apple crop at 25%.

City pest. Though this insect occurs in the country and occasionally is quite destructive to fruit and other trees, it is in the cities and towns that it flourishes and proves most injurious. The cause for this is found largely in the protection afforded by the English sparrow, which not only fails to feed upon it, but drives away native birds that would. A curious instance of the survival of the fittest and the danger of importing some natural enemy for the purpose of keeping in check an injurious insect, is shown by Dr J. L. LeConte (see citation), who instances the extermination of *Ennomos subsignarius* Hübn. in Philadelphia by this imported bird. After the destruction of *Ennomos*, the larvae of *Notolephus* found abundant food and, being unmolested by the sparrows on account of their irritating hairs, they soon became an even worse pest than the former species.

Description. A casual observer may have his attention arrested by an unusually pretty caterpillar with a coral red head, a pair of long black plumes just over it, a single one at the opposite extremity of the body, four delicate yellowish or white brush-like tufts on its back and just behind them, separated only by a segment, two small, retractile, red elevations. Along the back, except for the tubercles and tufts, there is a broad black band bordered by yellowish subdorsal stripes. Each side is dark gray, except the yellowish tubercles. A black line indicates the position of the spiracles or breathing pores, and below this latter line it is yellow, the legs being paler (fig. 1, a). This gives the general appearance of the caterpillar after it has become half or two-thirds grown, and at a time when its depredations begin to be apparent.

The recently hatched larva is a pale yellowish or whitish creature with long, irregular hairs. As it feeds, increases in size, and casts its skin from time to time, one after the other of the characteristics of the full grown larva is assumed.

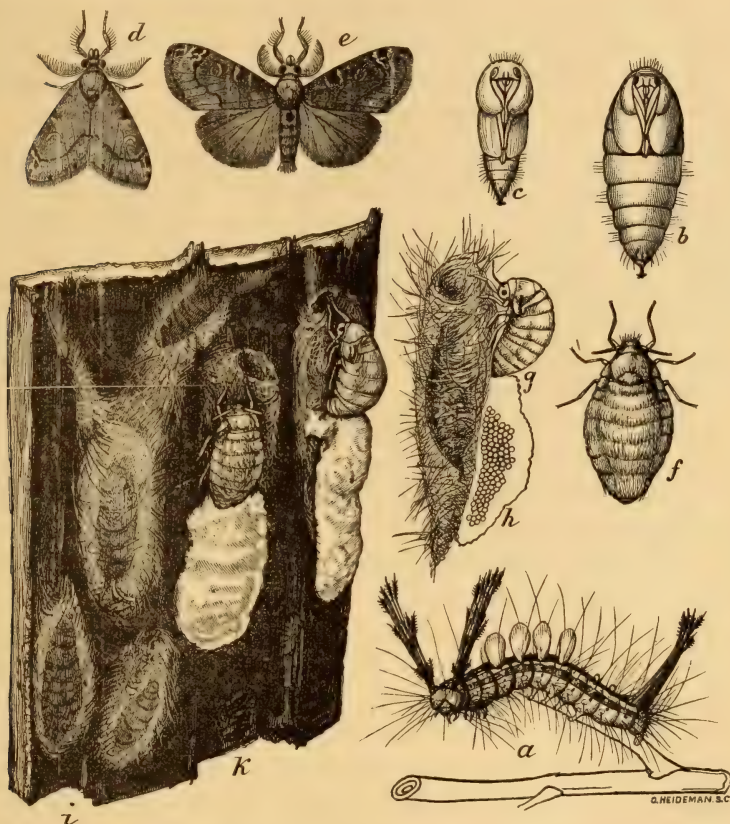


Fig. 1. *NOTOLOPHUS LEUCOSTIGMA*. *a*, larva; *b*, female pupa; *c*, male pupa; *d*, *e*, male moth; *f*, female moth; *g*, same ovipositing; *h*, egg mass; *i*, male cocoons; *k*, female cocoons, with moths laying eggs—all slightly enlarged (after Howard [Division entomology], U. S. Dep't agriculture, year book, 1895).

When maturity is reached, the larvae spin their thin cocoons in the crevices of the bark (fig. 1, *i*), interweaving their long hairs, and within this shelter transform to yellowish white pupae more or less shaded with dark brown or black (fig. 1, *b*, *c*).

The difference between the sexes in the adult stage is strikingly shown by comparing in figure 1, *d* and *e*, illustrations of the male, with *f*, that of the female. The former is a beautiful moth with large feathery antennae, the legs tufted, and the wings and body delicately marked with

several shades of gray and grayish white. On the other hand, the female is a nearly uniform gray, with simple antennae, and but rudimentary wings.

The eggs are deposited on the empty cocoon under conspicuous white masses of froth (fig. 1, *h*, *k*), which soon hardens and forms a very effective protection. The individual egg is nearly spherical, about $\frac{9}{10}$ mm in diameter, white or yellowish white, and with a light brown spot surrounded by a ring of the same color.

Life history. The winter is passed in the egg, the young emerging about the latter part of May in this latitude. In his studies of this insect, Dr Riley observed that the larvae molted seven days after hatching, and thereafter every six days till mature, males being produced from those that passed through but four stages and females from those exhibiting five or six. The rearings by Dr Dyar, indicate that the males have six stages and the females six or seven. The growth of the caterpillars occupies a month or a little more, pupation occurring the latter part of June and early in July. In Albany most of the larvae had pupated by July 7 of the present year, and some recently deposited egg masses were to be seen. In New York city the eggs began to hatch May 25, 1883, and the larvae to pupate about June 21, according to Clarkson (see citation). A few individuals spin up earlier than the mass and some do not till numerous egg clusters indicate that most have already completed the round of life.

From 10 to 15 days are passed in the pupa state. At the end of this period, the wingless female emerges and crawls upon her cocoon, pairing takes place, and immediately afterwards deposition of the eggs begins, as stated by Dr Howard. They are laid in a mass as described above, the eggs of a cluster ranging in number from 100 to 500, as given by several writers. In what appeared to be a good sized mass collected in Albany, there were 330 eggs. After her full complement has been discharged, the female dies and usually drops to the ground. In Albany there is normally one annual generation, but in New York city and vicinity and in Boston, Mass., there are two broods, while at Washington, D. C., there are two and probably three broods each year, according to Dr Howard.

Habits of the species. The young larvae feed upon the under surface of the foliage, and as they increase in size more and more holes are eaten, till, when full grown, all but the main ribs of the leaves are devoured. A peculiar habit, recorded by Dr Lintner but not observed

by others outside of Albany, is the girdling of elm twigs by the larvae of this insect. This is caused by their eating a portion of the bark around the twig near the beginning of the season's growth. The affected tips soon die, break off, and fall in numbers to the ground. The larvae drop from the trees readily, specially when young, suspending themselves by silken threads, and then may be blown or carried considerable distances. When nearly full grown, the caterpillars travel to a great extent, this is said to be specially true of the larger ones, females, and more likely to occur if they are very abundant. At such times there may be quite a migration to other trees. The cocoons are found very generally on the trunks and particularly on the under side of the larger branches. The wingless females, at the time they emerge from their cocoons, attract large numbers of the opposite sex. Dr Lintner records an instance of one attracting 100 males within an hour. Collections at electric lights in Poughkeepsie, N. Y., by Dr Dyar, show that the males fly during July and into August.

Food plants. Though this insect is commonly destructive to comparatively few trees, it has been recorded as feeding on a number of plants, as the following list will show: Linden, ^a geranium (*Pelargonium*), ^a grape, horsechestnut, buckeye, maples (specially the soft and Norway), box elder, honey locust, apricot, garden plum, wild plum (*Prunus chicasa*), garden cherry, choke cherry, rose, pear, apple, quince, ash, castor-oil plant, elm (several species), hackberry (*Celtis*), sycamore or buttonwood, butternut, black walnut, hickory, oak, birch, alder, willow, poplar, spruce, fir, larch and cypress. Though Dr Howard excludes conifers from the food plants of this insect, the species mentioned above are given on the authority of records by earlier writers. It is probable that farther observation would lead to a much greater extension of this list, and certain ones might have to be thrown out on account of the larvae eating them only under most exceptional circumstances.

Distribution. This native species 'ranges from Jacksonville, Fla., to Nova Scotia on the eastern coast and extends west certainly as far as Keokuk, Ia., and probably farther.' (Howard ^b) It has been recorded as common in Nebraska by McMillan, and Prof. F. L. Washburn (see citation) reports the same from Oregon.

Other forms of *Notolophus*. There are several other species in the country belonging to this genus, one of which, *N. definita* Packard,

^a Not previously recorded to my knowledge.

^b Year book. U. S. Dep't agriculture. 1895. p. 368.

has long been confused with *N. leucostigma*. As an aid to the ready identification of these interesting larvae, the following table by Dr Dyar, is reproduced:

Synopsis of the larvae of *Notolophus*

Head yellow, colors in general pale *definita*

Head red

A distinct yellow subdorsal band *leucostigma*

Gray marks predominate, the yellow band not noticeable var. *inornata*

Head black

Warts crimson, brush-like tufts dark along the crest,
the yellow lines along the sides broken into spots

One black tuft in young larva *vetusta*

Two black tufts in young larva var. *cana*

Warts orange, brush tufts unicolorous, yellow or
white, side lines usually continuous

A lateral black hair-pencil from joint 6. *antiqua*

No lateral black pencil. var. *badia*

Natural enemies. If the experience of later years is any criterion, certain native birds may well be regarded as most effective natural

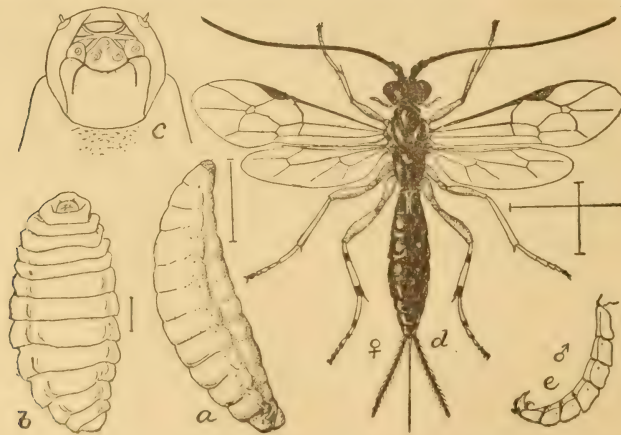


Fig. 2: *PIMPLA INQUISITOR*: *a*, full-grown summer larva; *b*, hibernating larva; *c*, mouth-parts of larva; *d*, adult female; *e*, abdomen of adult male from side—all enlarged; *c*, greatly enlarged. (after Howard: U. S. Dep't agriculture, Division entomology. Tech. ser. no. 5, 1897).

checks upon this species. The following are those named by Dr Lintner as feeding upon the caterpillars of this pest: The robin, *Merula migratoria* Linn., the Baltimore oriole, *Icterus galbula* Linn., the black-billed

cuckoo, *Coccyzus erythrophthalmus* Wils., and the yellow-billed cuckoo, *Coccyzus americanus* Linn. It will be found true as a rule, that in cities where these birds are absent or have been driven out by the English sparrows, this pest flourishes, while in the country, where the native birds are more abundant, this insect is rarely injurious.

The insect parasites of this species are extremely valuable allies and should be encouraged in every practical manner. The recent extensive studies of these by Dr L. O. Howard (see citation), have made valuable and very material additions to our knowledge of these interesting forms. He has shown that in Washington, D. C., *Pimpla inquisitor* Say and *Chalcis ovata* Say (fig. 2, 3) are the two species most effective in controlling this pest, and that large numbers of the former insect hibernate as larvae within the cocoons of the host, while in no instance was the latter parasite reared from cocoons of *Notolophus* taken the previous winter. He

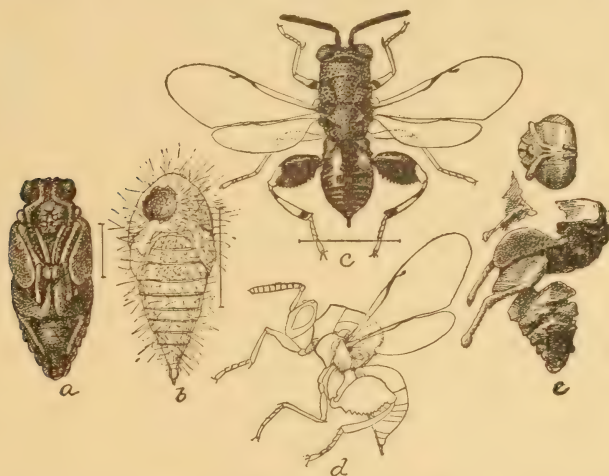


Fig. 3: *CHALCIS OVATA* : a, pupa; b, parasitized pupa of *Notolophus*; c, adult; d, outline of same from side; e, pupal exuvium—enlarged (after Howard: U. S. Dep't agriculture, Division entomology. Tech. ser. no. 5, 1897).

has also shown that when hymenopterous parasites are comparatively scarce, certain tachinids may destroy large numbers of this pest, the more important being *Tachina mella* Walk., *Frontina frenchii* Will. and *Euphorocera claripennis* Macq. Besides those mentioned above, Dr Howard gives the following as primary parasites of this species: *Pimpla conquisitor* Say, *Pimpla annulipes* Say, *Amorphota orgyiae* How., *Meteorus communis* Cres., *Meteorus hyphantriae* Riley, *Limneria* sp., *Limneria valida* Cres., *Theronia fulvescens* Brullé, *Apanteles delicatus*

How., *Apanteles hyphantriae* Riley, *Apanteles parorgyiae* Ashm., *Pteromalus cuproideus* How., *Cratotechus orgyiae* Fitch, *Telenomus orgyiae* Fitch, *Frontina aletiae* Riley, *Exorista griseomicans* V. d. W. and *Winthemia 4-pustulata* Fabr. At Washington these parasites became so abundant that in the autumn of 1895 about 90% of the larvae were destroyed. In addition to the above named parasites, Dr Howard records that *Ichneumon subcyaneus* Cres., *Ichneumon coeruleus* Cres. and *Allocota thyridopterigis* Riley were all observed investigating recently formed *Notolophus* cocoons and were apparently about to oviposit. The latter, he states, is parasitic upon *Pimpla*.

In his study of these parasites, Dr Howard found that the conditions were not uniform in all parts of the city of Washington, the parasitism being more general in the vicinity of the grounds of the Department of agriculture, where most of the observations were made, than in other portions of the city. The difference due to locality is also shown by the ^a parasites in the state collection reared by the late Dr Lintner from this species, though his study of them was by no means so extensive as that at Washington. The one occurring most abundantly was *Tachina mella* Walk. *Pimpla hirticauda* Prov., a species not hitherto recorded from this insect, was bred in greater numbers than any other of the larger hymenopterous parasites. Most of the individuals belonging to this species were reared in July, but two appearing in June and a few others in August. *Pimpla inquisitor* Say, *P. conquisitor* Say and *P. annulipes* Brullé occurred in about equal numbers. Of the smaller primary parasites, *Pteromalus cuproideus* How. and an unnamed species belonging to the same genus were about equally abundant.

Though the list of primary parasites is long and includes some very important species, many of these are in turn the victims of enemies. The parasites breeding in those which prey upon injurious forms must be classed as enemies to man, since they protect a species indirectly by destroying large numbers of its parasites. One of the most abundant of the hyperparasites reared by Dr Howard at Washington was *Dibrachys boucheanus* Ratz. (fig. 4), it being present in such force as to almost kill off *Pimpla inquisitor* the latter part of 1896. This species was also reared in large numbers by Dr Lintner in 1883. It is in turn, as demonstrated by Dr Howard, preyed upon by *Ascodes albitarsis* Ashm. The following is a list of the hyperparasites of *Notolophus leucostigma*, as given by Dr Howard: *Hemiteles towsendi* Ashm., *Bathythrix metcouri* How.,

^a Determined through the courtesy of Dr L. O. Howard.

Bathythrix pimplae How., *Adistola americana* How., *Otacustes periliti* Ashm., *Habrocytus thyridopterigis* Ashm., *Pezomachus insolitus* How., *Spilochalcis debilis* Say, *Eupelmus limneriae* How., *Dibrachys boucheanus* Ratz., *Elachistus cacoeciae* How., *Elasmus atratus* How., *Syntomosphyrum esurus* Riley and *Asecodes albitarsis* Ashm.

A number of scavengers were reared by Dr Howard from the pupae or masses of cocoons. The list is as follows: *Helicobia helicis* Towns.



Fig. 4 *DIBRACHYS BOUCHEANUS*: 'a, larva; b, pupa; c, adult female—greatly enlarged; 'd, head of larva; e, antenna of adult—still more enlarged (after Howard; U. S. Dep't agriculture, Division entomology. Tech. ser. no. 5, 1897).

Sarcophaga species, *Phora nigriceps* Loew, *Phora incisuralis* Loew, *Phora fasciata* Fall., *Phora agarici* Lintn., *Limosina* species, *Homalomyia scalaris* Fabr., *Gaurax anchora* Loew, *Neoglaphyroptera bivittata* Say and *Diplosis* species. This and the preceding lists illustrate in a remarkable degree the large number of forms that may depend more or less upon one species, and afford interesting examples of the relations that may exist between various insects.

In addition to these, a Eulophid was reared in some numbers from the cocoons of *Notolophus* by Dr Lintner in 1883 and 1884. A dermestid beetle, *Perimegatomia variegatum* Horn, has been recorded in *Insect life* as a very effective destroyer of the eggs of *Notolophus* in California. The wheel bug, *Prionodus cristatus* Linn., is said to prey upon the larvae in the southern states. The present season a mite, a species of ^a *Rhyncholophus*, was observed eating the contents of many eggs.

^a Determined through the courtesy of Dr L. O. Howard.

Remedies. The simplest and most satisfactory remedy is found in gathering and destroying the egg masses. As the eggs are in a compact mass which is readily torn from the supporting cocoon, either by hand or some form of a scraper, the task is easily and quickly performed. Dr Howard has recommended the use of creosote oil for the destruction of the eggs, since each mass has only to be moistened with the substance. In winter it is necessary to add some turpentine in order to keep the creosote liquid. On account of the female being wingless, a tree once thoroughly cleaned will not become reinfested very soon if larvae are not abundant nearby, and even then a band of loose cotton bound tightly around the trunk will prevent their ascending and a consequent reinfestation. It should be kept in mind that only the eggs must be collected or destroyed, on account of the beneficial parasites which may occur in cocoons not bearing egg masses. This is specially true in the autumn and applies to a certain extent in the spring, since it has been shown that some parasites hibernate as larvae within the cocoons of the host, and if these are collected and destroyed, it means the death of many beneficial forms. The egg masses are more readily seen after the leaves have fallen and in localities like Albany, where one annual generation is the rule, the gathering of the eggs may well be deferred till autumn. In the case of Boston, New York city and more southern localities, it may be necessary to collect in midsummer those laid by the first brood of moths.

In case it is impracticable to collect the eggs, dependence must be placed upon spraying with some arsenical compound. This is satisfactory if properly done early in the season under favorable conditions. In many instances there will be more or less delay and in practice it is very difficult to have the spraying properly done, and then there may be hindrances incident to several days or a week of rain at the time the poison should be applied.

Not a few wait till the trees show signs of serious injury and then ask for some means of stopping the ravages. Resort may be had to spraying with a larger proportion of poison in order to kill the larvae quickly or they may be shaken from the limbs, provided the tree is not too large. The latter means will give a certain amount of relief where practicable and may be made more effective by the use of cotton bands to prevent the ascent of those shaken from the tree.

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^a Previously this insect has been very generally referred to the genus *Orgyia*.

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CLISIOCAMPA AMERICANA *Fabr.**Apple-tree tent caterpillar***Ord. Lepidoptera : Fam. Lasiocampidae**

The wide-spread and severe ravages of the tent caterpillar the last two or three years have led to a more general desire for knowledge about this species. Though its life history and habits are well known to entomologists and have been repeatedly published, yet, aside from the occurrence of the larvae in their nests from spring to spring, many seem to have little idea of the insect's habits.

An old and familiar pest. This species attracted the attention of the earliest entomologists. Its conspicuous white nests in the forks of cherry trees along the roadsides and in the neglected orchards of New England were well-known features of the landscape during the spring



Fig. 5 Wild cherry-tree defoliated by tent caterpillars (after Weed, C. M.).

months in the latter part of the 18th century as well as in the 19th. In the latter part of May it is by no means uncommon to see many of the wild cherry-trees beside the country roads practically leafless, and swarm-

ing with the caterpillars of this insect, which have issued from the one to 20 or more nests on each of the hapless trees in the search for food. Though this species is easily controlled, as will be shown later, the common practice is apparently to let the caterpillars alone, trusting that natural agents will keep them in control.

Extensive ravages during the past two years. As a result of allowing nature to have her course after the balance between the various forms of life has been disturbed by man, this insect causes more or less damage every year, and frequently commits extensive depredations. The latter has been the case the last two seasons. Complaints were received from many localities of the abundance and destructiveness of these caterpillars. Not only were the native cherry-trees defoliated, but apple orchards suffered severely from the attacks of this insect, specially in the western part of the state where many were stripped of their leaves. Mr S. D. Willard, of Geneva, N. Y., informed me last spring that tent caterpillars had caused him an unusual amount of trouble, though he had kept close watch of them. In some localities the losses were increased by the ravages of the so-called forest tent caterpillar, *Clisiocampa disstria* Hübn., which was also abundant and in some counties excessively injurious. The Weather crop bulletins issued in May and early June of last year give some indication of the widespread abundance of this insect. Such comments as: 'Apple-trees covered with caterpillars,' 'Caterpillars more numerous than ever before,' 'Caterpillars have ruined some orchards,' 'Many trees nearly stripped by worms,' and similar expressions from widely separated localities may all be referred to this insect with comparative certainty, and indicate its destructiveness in neglected orchards. From Cambridge, N. Y., came the report last year that the place was simply overrun by the apple-tree tent caterpillar. In 1898 the Weather crop bulletins contained the following observations: 'Tent worms hatching out thick,' 'Tent worms unusually numerous,' 'Tent worms very thick in places.' The unusual abundance of this familiar pest was patent to anyone traveling in 1897 and 1898, the latter part of May or early in June, either in this or some of the adjacent states. In many portions of Massachusetts leafless trees testified to the work of this enemy, and in Vermont the same conditions prevailed to a greater or less extent.

Description. Though the tent caterpillar is a very common insect and familiar to almost everyone when found in its conspicuous white nests in the spring, many are unable to positively recognize the larva, unless seen near its nest, few can identify its egg belts, while a still smaller number have any idea of the appearance of the parent moth.

The glistening brown egg belts encircling the smaller twigs of the tree are from $\frac{5}{10}$ to $\frac{7}{10}$ of an inch long. Sometimes the mass of eggs does not completely embrace the twig, though usually there is a more or less narrow union on one side. The ends of the egg mass curve gradually down to the twig, the outer eggs inclining and the outermost lying almost flat, in order to permit this shape. The normal egg mass of this insect is so thickly covered with the glutinous secretion that the individual eggs are invisible. The young caterpillars are rarely observed till they have attained some size and their webs on the smaller limbs have become visible. The full grown larvae and their characteristic tents are too well known to need description in connection with the accompanying figure. The yellowish, oblong, oval cocoons with a loose

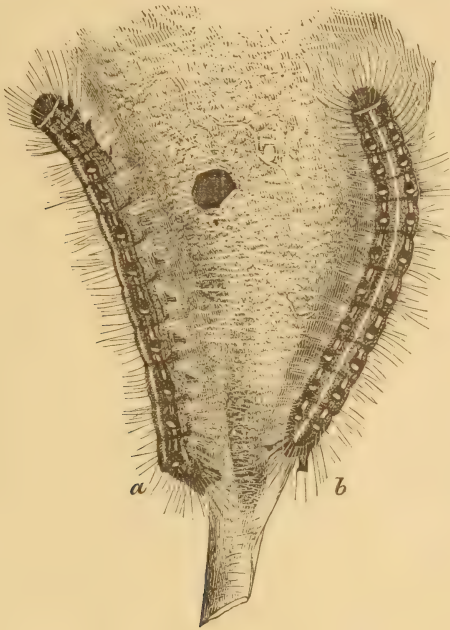


Fig. 6. Tent caterpillars and nest (after Riley).

texture are not generally recognized as being the product of the familiar tent caterpillar. It will be noticed that when these cocoons are handled, a yellow, sulphur-like powder sifts out. This is the dried paste intermingled with the silk at the time the cocoon is spun. The parent moth is buff-colored, with two parallel oblique white lines across the fore wings. The female is about one third larger than the male (see figure 7, *a, c*).

A hermaphrodite. Bisexual or hermaphrodite individuals are among the rarities in the insect world and such examples are highly prized by collectors. This specimen was mentioned by Dr Lintner in the transmittal of his 7th Report as a very interesting rarity, and the present opportunity is taken of recording its features in a permanent



Fig. 7. *CLISIOCAMPA AMERICANA*, *a*, male; *b*, hermaphrodite; *c*, female (original).

form (see fig. 7, *b*). The left wings and antenna show so clearly the characters of the female represented above and the right wings and antenna those of the male below, that farther comment is hardly necessary.

Life history and habits. The young are frequently formed within the eggs in the autumn, and only await warm weather before coming

forth. It has even been stated by Mr H. C. Raymond, of Iowa, that the eggs often hatch in the autumn and that the vitality of the larvae enables them to winter successfully in that latitude. According to Riley, the eggs frequently hatch during an early warm spell and before there is anything for the larvae to feed upon, they subsisting for a time upon the glutinous matter surrounding the eggs. At first the nests are very small and afford little protection to their inmates, but as the caterpillars never move without spinning a thread and frequently crawl over their tents, the nests soon become much denser and afford considerable shelter from the weather. Many have probably noticed that the nests or tents are composed of a series of layers of silk with just about room enough between for the caterpillars and they may have wondered how the larvae began a new layer. The explanation given by Dr Fitch is simplicity itself. During fair weather the caterpillars frequently rest in numbers on the outside and stray individuals may be seen crawling over their resting companions, spinning as they go, and at the same time beginning a new layer of silk. Dr Fitch states that on damp or rainy days they remain in their nests, but during fair weather they usually feed for a time in the morning, again in the afternoon and once during the night. These habits are subject to considerable variation, being affected to a great extent by the weather. As the larvae approach maturity, they forsake the nests and wander singly in all directions, feeding on whatever they can. At this stage they will pupate upon the slightest provocation. More than once have I put a caterpillar of this species in a box, only to find a cocoon the next morning. The instinct that prompts them to wander at this time is undoubtedly a wise provision for their safety, for it insures their pupation in widely separated places and renders them less likely to be destroyed. Early in June the cocoons of this species are spun on the trunks of the trees, on the under side of fence rails, under the eaves of buildings and in many similar places promising shelter. An interesting deviation from the general habit the caterpillars have of each spinning a cocoon, is that recorded by Miss Allie C. Simonds, of Fayetteville, Ark., who reported that numbers of individuals spun large irregular cocoons in common, as many as seven or eight pupae being found crowded together in one without any separating partitions (*Insect life*. 1895. 7:429). The caterpillars transform within the cocoons to brown pupae and remain in this state for about three weeks, according to Fitch and Riley. Prof. Slingerland, as a result of certain trap lantern experiments, records taking the moths from June 17 to July 18, at Ithaca, N. Y., in 1889, the great majority being taken between June 22 and July 5.

In 1890, Dr Dyar has recorded taking the moths at electric lights in Poughkeepsie, N. Y., from June 14 to July 17, the larger number occurring between June 20 and July 2.

During this period of flight the eggs are deposited in bands or belts around the smaller twigs, the number in a band ranging from 300 to 330 according to Dr Fitch.

Food plants. The wild cherry, *Prunus serotina*, is undoubtedly the favorite food plant of the tent caterpillars, since the examples along the roadsides suffer more or less from year to year and are frequently defoliated by this pest. The apple appears to rank next in the estimation of the caterpillars, judging from the severe attacks made upon it yearly. This insect feeds on a large number of plants, though severe injury is usually confined to those named above, and closely related species. It has been reported by various authors upon the following: barberry, New Jersey tea (*Ceanothus americanus*), sugar maple, plum, peach, several species of cherry, rose, thorn (probably *Crataegus*), shad-bush, pear, apple, mountain ash, witch hazel, elm, oak (probably several species) several species of birch, willow and poplar. Some of these are undoubtedly eaten only under exceptional circumstances, and others sustain serious injury occasionally. Dr C. M. Weed, of Durham, N. H., gives illustrations of a severe attack on a birch and an oak in a recent bulletin.

Distribution. This insect appears to be generally distributed throughout the eastern United States, and extends north into Canada. *Clisiocampa fragilis* Stretch is given by Dr Dyar as the representative of *C. americana* from the Rocky mountains to the Sierras and from Canada to Mexico, and it in turn is represented in the Pacific northwest by *C. pluvialis* Dyar.

Natural enemies. This species is attacked by a number of parasitic and predaceous insects and is also subject to a fungus disease, but in spite of these checks the caterpillars are frequently very abundant. Among the most important true parasites may be mentioned *Pimpla pedalis* Cres., a species which Dr Fernald has bred in great numbers from the cocoons. It was so abundant that he obtained only 25 moths from about two quarts of cocoons. Many examples of *Pimpla conquisitor* Say were reared from the pupae of this insect by Dr C. M. Weed. According to Dr Howard, the latter species is found from California to New Jersey and south to the Gulf of Mexico and has been recorded from Canada. He classes it as one of the most important parasites of the cotton-worm in the south, and as it preys on a number of injurious

lepidopterous insects, it may well be regarded as a very beneficial form. Another insect belonging to the same genus, *P. annulipes* Brullé, has been recorded as a parasite of this species, by Bruner. In addition to *P. pedalis*, Dr Fernald reared a few examples of *Theronia melanocephala* Brullé from cocoons. A variety of *Apanteles congregatus*, *rufocoxalis* Riley, was bred from the larvae by Dr Lintner. Dr Fitch reared from the cocoons a parasite to which he gave the name of

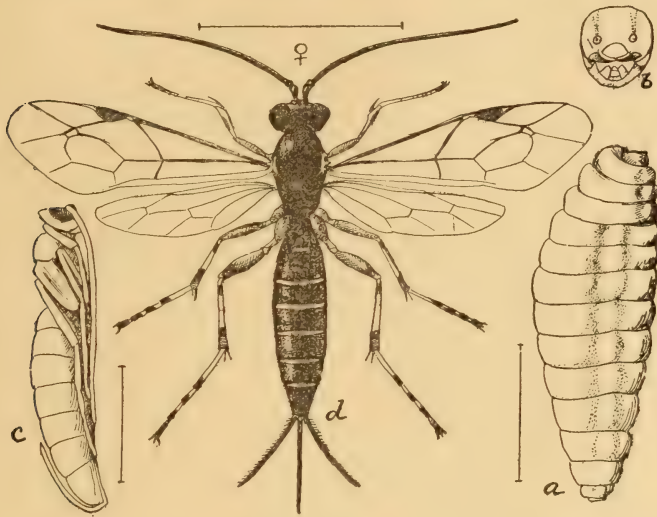


Fig. 8 *PIMPLA CONQUISITOR*: a, larva; b, head of same; c, pupa; d, adult female — all enlarged. (after Howard; U. S. Dep't agriculture, Division entomology. Tech. ser. no. 5).

Cleonymus clisiocampae. Dr Howard states that Mr Ashmead has referred this species to the European *Dibrachys boucheanus* Ratz., which is not a primary parasite, as Dr Fitch supposed his species to be. *Telenomus clisiocampae* Riley, has also been reared from the eggs of this and another species of *Clisiocampa* (*Insect life*. 1891. 4:123). But one parasitic fly, *Frontina frenchii* Williston, has been reared from the tent caterpillar, according to Coquillett.

A number of predaceous insects attack the larvae. Several species of large ground beetles are said to prey on the caterpillars, among them being *Calosoma scrutator* Fabr. As others of the same genus attack *Clisiocampa disstria* Hübn., it is probable that they would not discriminate between the larvae of these closely related forms. Owing to the extended studies of Mr Kirkland, we know more fully the habits of the genus *Podisus*, several species of which attack the tent caterpillar. The following have been observed preying on *C. americana*: *Podisus placidus* Uhler, *P. modestus* Dallas, *P. serieventris* Uhler, and *Diplodus luridus*

Stål. As a rule, members of this genus are beneficial and should be protected, since they are mostly predaceous in habit. Professor Bruner states that *Podisus spinosus* Dallas and *Perillus claudus* Say prey upon the tent caterpillar.

Among the more efficient vertebrate enemies may be named the American toad, though its feeding on this species is practically limited to the relatively short period when the larvae are wandering in search of proper places for pupation. Mr Kirkland has found the remains of 37 full grown caterpillars in the stomach of one toad and from 15 to 20 in many others. The value of birds in keeping this and other pests under control is strikingly shown in an experiment conducted by Mr E. H. Forbush, ornithologist of the Massachusetts board of agriculture. In a typical orchard in Medford, Mass., a little trouble was taken to attract the native birds, the nests of the English or house sparrow being destroyed. The results were greatly in favor of protecting our indigenous forms. In neighboring orchards it was evident that canker worms and tent caterpillars were very numerous, but in the orchard in question, the trees were injured seriously in only one or two instances, though no attempt was made to control the insects by spraying or other artificial means. The following is a list of the birds observed feeding on the tent caterpillar in that Medford orchard: Crow, *Corvus americanus* Aud.; chickadee, *Parus atricapillus* Linn.; oriole, *Icturus galbula* Linn.; red-eyed vireo, *Vireo olivaceus* Linn.; yellow-billed cuckoo, *Coccyzus americanus* Linn.; black-billed cuckoo, *Coccyzus erythrophthalmus* Wils.; chipping sparrow, *Spizella socialis* Wils.; yellow warbler, *Dendroica aestiva* Gmel. This list includes all the species observed feeding on the tent caterpillar by earlier writers.

Preventive measures and remedies. It will not do to rely entirely on the good offices of native birds for keeping this or other insect pests under control, though they are undoubtedly of great value and richly repay any slight effort that may be made for the purpose of attracting them to orchards. Winter birds are induced to remain in the vicinity of orchards by hanging in the trees pieces of meat or partially picked bones, and will spend much time in searching out and devouring numerous insects or their eggs, relying on the meat only when conditions are unfavorable for obtaining insect food. Migratory birds may be induced to remain in larger numbers near orchards by providing them with suitable nesting places and materials, and by protecting them from cats and cruel boys. Thickets in the vicinity will afford shelter for

certain species and if a few mulberry trees are set out their fruit will serve to protect the cherries as the birds are said to eat the mulberries by preference. Most of the preceding suggestions are taken from a very interesting and practical paper by Mr Forbush (see citation). His many years of experience and close observation of our birds entitle his writings to the highest respect. There is much that can be said in favor of protecting and encouraging our native birds and most farmers will find that a little effort along this line will be very profitable. In undertaking any such work, it will not do to judge entirely by the results obtained in one season.

As this species breeds from year to year in large numbers on the wild cherry-trees along the roadsides, in fence corners and other uncultivated places, these trees should either be destroyed or else used as lures and heavily sprayed with poison early each spring in order to destroy the numerous caterpillars hatching from their abundant egg belts. It is probable that the destruction of the cherry-trees would be the wiser plan, for otherwise they would be too often neglected as is the case at present. If but a few wild cherry-trees were allowed to grow near an orchard and they were well sprayed with poison from year to year or the numerous egg belts removed, it is probable that the tent caterpillars would be found on the apple trees in comparatively small numbers.

The exhaustive experiments, conducted by Dr Fernald, on the amount of paris green necessary to kill this species, show most conclusively that the caterpillars can be readily controlled by spraying with poison. The experiments prove that the larvae in any stage can be killed in two or three days with an application of one pound of paris green in from 300 to 400 gallons of water, and that even the extremely dilute mixture of one pound to 1000 gallons is deadly in two or three weeks after application. While in practice it will be found best to use paris green at the rate of one pound to 200 or 300 gallons or less, the experiments show that this species is much more sensitive to arsenical poisons than is the case with the gypsy moth, *Porthetria dispar* Linn., the spring canker worm, *Paleacrita vernata* Peck, and some other injurious species. In cases where it is desirable to spray the trees early in the spring for the purpose of controlling other insects, the same application should be entirely effective in preventing injury by tent caterpillars.

If for some reason or other, it is not desirable to spray at the proper time to kill this species, recourse may be had either to gathering the egg belts in the winter or early spring and destroying them, or to the destruction of the young when assembled in their recently formed nests. The

collecting of the eggs is best done when the trees are leafless and the sky clear or covered with whitish clouds. A little experience will enable one to detect the egg belts very readily. There are several methods of destroying the young caterpillars in their nests. The most effective way is by crushing them with the hands, mittens may be worn if preferred, as suggested by Dr Fitch. If the nests are attended to early in the season, the operation is quickly and thoroughly done, as most of them are within reach of a short ladder. The nests may be torn out with a brush, a dry mullen stalk or other arrangement and their occupants crushed on the ground. This is not so thorough as crushing the caterpillars while on the tree. Another method is burning the nests by the use of rags soaked in kerosene and tied to a pole or other form of a torch. When the flames are brought under the nests, the occupants escape so far as possible by dropping. It is seldom that every caterpillar on the tree is destroyed by this means. Not only do a number escape, but in many cases the trees suffer severe injury, the entire branch beyond the nest being killed by the fire. It would be better to cut off the branches bearing nests, as is done by some, and then destroy the caterpillars either by fire or by crushing them.

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CLISIOCAMPA DISSTRIA *Hüb.**Forest tent caterpillar***Ord. Lepidoptera : Fam. Lasiocampidae**

This species is closely allied to the preceding in structure and habits, as might be inferred from the similarity of their names, and like its congener is frequently very destructive. From the fact that this insect is confined largely to the forests, as indicated by its common name and the scientific one bestowed by Harris, its operations are more rarely brought to notice, and then only when it has committed extensive ravages.

Injuries the past two years in New York state. The ravages of this insect in New York state this year and last have been unprecedented in the annals of our state. In fact, there appears to be no record of injury earlier than 1857, when it was reported to Dr Riley as quite destructive in certain parts of western New York. 10 years later Peter Ferris (see citation) reported that this insect had been troublesome in western New York for 12 years or more. The next serious outbreak was brought to the attention of Dr Lintner in 1889 from Kingsbury, Washington county, N. Y., where about 10 acres were defoliated. These depredations, however, sink into insignificance compared with those reported to Dr Lintner last year and the more wide spread injuries brought to my notice the present season. In 1897 this species was reported by Prof. John Mickleborough as very destructive to maples and other forest trees at Jewett, Greene county. At Andes, Delaware county, its ravages were complained of by Barton Jackson. The most serious injuries reported that year were in the vicinity of Margaretville, in the same county. The following excerpts from a report made by Henry B. Ingram, of Kingston, N. Y., will give an idea of their abundance and the extensive depredations committed:

The cocoons of this insect in the infested district fairly whitened the places where they were attached. Under the eaves of buildings, under the lower edge of every clapboard on buildings, in piles of brush, under every loose stone, piece of bark or board, in the crevices of the bark on trees and every place where a worm could hide and undergo its transformations—all these were found crowded with cocoons.

The part of Delaware county visited by me on Thursday, July 8, 1897, was Arkville and Margaretville along the Ulster and Delaware railroad. The first place I visited was what is known as Ely Swart's sugar bush, one mile and a half east of Margaretville village. This sugar orchard, or rather, sugar maple forest, comprises about 60 acres. Then the maple trees continue in a dense forest through other farms up and over the mountains for several miles. It is about half a mile wide, and begins in the valley near a long siding half a mile from Arkville,

where the Ulster and Delaware railroad sometimes side-track freight trains. The caterpillars began their depredations at this railway siding and swept up the hill over an area a mile and a half long by half a mile wide, taking hard maple, apple, pear, plum, beech, birch, poplar and other trees in their destructive course. The nut trees they did not attack and strange to say, they left every soft maple in their track untouched.

The caterpillars were also operating in the village on the shade trees, and the garden fruit trees, but were not plentiful enough to do much damage or cause much comment.

At Clarks Factory, Delaware county, Mr H. O. Van Benscoten owns an extensive sugar orchard of over one hundred acres. It has been stripped of its foliage till not one leaf remains. The maple forests, at Andes, Grand Gorge, Bush Ridge, and Fleischmanns, Delaware county, Prattsville and other points in Greene county have also been stripped of foliage. Wherever the caterpillars have appeared they have defoliated the apple and fruit orchards.

The complete and extensive injury is well shown in plates 1-4, which were taken by Mr Ingram.

This year Mr R. G. Smith reported that 125 acres covered with maples were defoliated at Russell, St Lawrence county. Severe ravages by this species were reported from Lewis county, many timber lots appearing as though fire had run through them, as it was put by a correspondent of the weather bureau. At Trenton Falls, Oneida county, the caterpillars were very numerous in the woods and some trees were nearly defoliated. Several observers reported serious injuries by this insect in Otsego county, Westford, Decatur and Worcester being localities specially mentioned by Mr O. Q. Flint, of Athens, N. Y. A report came to me that the forests were stripped by this species in Exeter, and Mr C. F. Wheelock, head inspector of the University, informed me that he had observed considerable injury to forest trees in the same county. Its ravages were noted in Delaware county by Mr Flint at Roxbury and Stamford. Many trees were defoliated in Greene county, its operations in Lexington and Halcott coming under the observation of Mr Flint and those at Tannersville being reported by Miss K. E. Turnbull. The abundance and destructiveness of this insect at Glens Falls, Warren county, was brought to my attention early in the season by Mr C. L. Williams. At Lake George many of the trees on the islands were defoliated by this insect, the Canoe islands appearing as though swept by fire, according to Mrs J. R. Gilmore. Severe injuries were also reported from Vermont both last year and the present season. That the actual depredator in cases cited above was always this species, could not be determined in every instance by examination of the caterpillars, though an effort was made to secure examples whenever practicable,

but it is believed that in every case the evidence justified the identification. In all the localities mentioned above, a number of trees were defoliated, usually oaks and maples, and in most of these the injured tracts could be estimated by acres, in some cases by hundreds of acres. There is certainly ample evidence to justify the conclusion that the forest tent caterpillar has caused a large amount of damage in New York state last year and this, and that the present season the ravages have been more general than in 1897, though in the former year they may have been more severe in certain localities.

Extensive depredations in other localities. This insect has been extremely injurious in a number of other states, in some instances defoliating hundreds of square miles. One of the earliest accounts is the record of Abbot, whom Dr Riley quotes, stating that it 'is sometimes so plentiful in Virginia as to strip the oak-trees bare.' In his 3d report (see citation), Dr Riley credits this species with completely stripping the 'over-cup timber' on the overflow bottoms near Des Arc, Ark., and records extensive injuries by it in many parts of Missouri. In the 8th *Report on the insects of Missouri*, it is stated that this species stripped oak forests over hundreds of square miles in the southern states, and that in the vicinity of Memphis, in 1862, the larvae were so abundant as to frequently stop trains going in and out of the city. In 1889 another instance of trains being stopped was brought to the notice of the Division of entomology, U. S. Department of agriculture (*Insect life*. 1889. 2: 58). This time the trouble was in Maine and was accompanied by serious injury to forests and orchards. Two years later trains were stopped on the Carolina central railroad near Lumberton (*Insect life*. 1891. 3: 477). This hindrance to travel was accompanied by the defoliation of many trees over a large area. This species was excessively injurious in the vicinity of London, Ont., in 1877, as recorded by William Saunders in the following words: 'There were millions upon millions of them, and so enormous were their numbers and so persistent their attacks, that after fighting them bravely for a week or two, many gave up the contest in despair, weary of the slaughter. Many an orchard was rendered bare and leafless and in some instances the woods were so void of foliage as to remind one of winter.' In southern Illinois this insect 'made a frightful inroad upon the apple orchard, absolutely defoliating every tree in large districts in 1883' (Forbes, see citation).

Last year the caterpillars committed very extensive ravages along the Ottawa river, stripping the aspen groves of every leaf and seriously injuring other trees (*Ottawa naturalist*. 1898. 12: 13).

Description. This insect can be distinguished from the preceding by the absence of the conspicuous white tents or nests. The forest tent caterpillars spin a web but it is much thinner than in the case of the species commonly occurring on apple-trees, and usually escapes observation on account of its being attached to the side of a limb, instead of stretched between diverging branches.

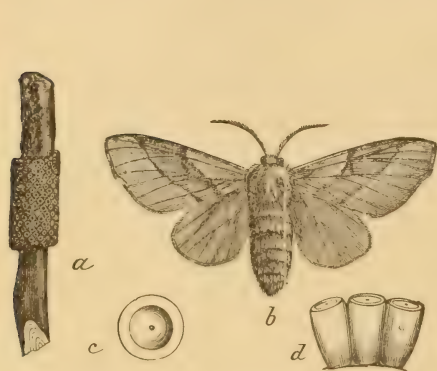


Fig. 9 Forest tent caterpillar: *a*, cluster of eggs; *b*, female; *c*, top view of an egg; *d*, side view of several eggs (after Riley).



Fig. 10 Larva (after Riley).

The egg belts are similar to those of the preceding species, except that the ends terminate abruptly, all the eggs standing upright (fig. 9). Each mass is composed of about 400 eggs, the number ranging from 380 to 416, according to Dr Riley. The young caterpillars are not often noticed. The recently hatched larvae have been characterized as 'black with pale hairs and are always found either huddled together or traveling in file along the silken paths which they form when in search of food.' After feeding for a time they become 'paler or of a light yellowish brown, with the extremities rather darker than the middle of the body, with the warts which give rise to the hairs quite distinct, and a conspicuous dark interrupted line each side of the back' (Riley). After the second molt the characteristic row of spots along the back appears (fig. 10) and enables one to readily distinguish between them and the apple-tree tent caterpillars. As the larvae increase in size and undergo successive molts, the colors become brighter and more distinct. The cocoon is very similar to that of *C. americana*. The moth is smaller, lighter colored and may be distinguished from that of the apple tree tent caterpillar by the oblique bands across the fore wings being darker instead of lighter than the ground color.

Life history and habits. The life history and habits of this species are very similar to those of the preceding form. The winter is passed by the fully developed larvae in the egg, as stated by several writers. With the appearance of the first warm weather, the caterpillars emerge and if no food is at hand, await the appearance of the leaves. While small they remain together, but as they approach maturity the individuals scatter in much the same way as the apple-tree tent caterpillars, though nearly full grown larvae, specially when preparing to molt, may be seen in large clusters covering a portion of the trunk as do those of the gypsy moth, *Porthetria dispar* Linn. Such an assemblage is really a pretty sight if one has an eye for the beautiful in nature. The larvae do not become full grown till somewhat later than the apple-tree tent caterpillars. As a general rule they wander everywhere the first part of June and disappear by the middle of the month, though I have observed numbers feeding the latter part of June and have seen them in the early part of July. The cocoons resemble those of *C. americana* very closely, and are found in similar places, except that the habits of this species necessitate the pupation of the larger proportion in forests. The duration of the pupa state is about two weeks. The moths appear the latter part of June and during July. Dr Dyar records taking this species at electric lights in Poughkeepsie, N. Y., in 1890, from June 20 to August 4, the adults being most abundant July 2 and 9.

Distribution. The numerous records of serious injury by this insect in the eastern United States and Canada indicate that it is widely and generally distributed. It has been reported from Mississippi north into Canada and from Maine westward to California. Dr Dyar states (see citation) that *C. distria* extends throughout the range of *C. americana* and *C. pluvialis* and also into California.

Food plants. Like the apple-tree tent caterpillar, this species can subsist on a large variety of plants. Its favorite species of oak in the southern states, as stated by Dr Riley, are those belonging to the same group as the black oak. In New York and adjoining states this insect is reported more frequently as defoliating the sugar maple than any other tree. This injury may be owing to the fact that large sugar orchards afford the most favorable conditions for the caterpillars in the north, and as the maples are of greater value than forest trees, complaints of attack are more frequent. The caterpillars have been reported by various writers as feeding upon the following trees and shrubs: linden, maples, locust, peach, plum, cherry, rose, strawberry, apple, sweet gum (*Liquidambar*

styraciflua), dog wood, 'black gum,' sour gum (*Nyssa sylvatica*), ash, elm black walnut, hickory, walnut, oak, black oak, post oak, white birch, gray birch, willow and poplar.

Natural enemies. On account of this insect's depredations being confined mostly to the woods, we must depend largely upon its natural enemies to keep it in check. In 1879, William Saunders records the destruction by a fungus disease of large numbers of larvae belonging to this species. Professor Forbes, state entomologist of Illinois, found a great many of these larvae dead in the southern part of that state. So fatal was the disease that from half to three fourths of the cocoons never yielded the imago. The next year, though enough larvae hatched to do considerable damage, many died when they were little over half an inch long and in some cases whole colonies were killed. Professor Forbes has identified this disease as muscardine, and though so deadly to the larvae, no attempt seems to have been made to cultivate and disseminate the fungus.

Very few true parasites have been bred from this insect. Dr Riley records the rearing of *Limneria fugitiva* Say and William Saunders states that *Pimpla pedalis* Cres. preys on this species. *Pimpla conquisitor* Say was reared from several pupae collected in Delaware county last year, the proportion of the cocoons parasitized indicated that it was very valuable in controlling this caterpillar. The following dipterous parasites have been reported by Mr Coquillett (see citation): *Euphorocera clari-fennis* Macq., *Frontina frenchii* Will., and *Tachina mella* Walk. A number of predaceous insects prey upon the caterpillars. One of great value is *Calosoma scrutator* Fabr., a species which Dr Riley characterized as most efficient. The beautiful and equally ferocious *Calosoma calidum* Fabr., is another valuable enemy, as stated by William Saunders. Mr Burgess (see citation) records that *Calosoma wilcoxi* LeC. fed readily in confinement upon the larvae of this insect. Two predaceous hemipterons, *Podisus placidus* Uhler and *P. serieiventris* Uhler are also known to feed upon the caterpillars (Kirkland, see citation). A mite, ? *Trombidium* sp., was discovered by William Saunders destroying many clusters of eggs. The vertebrate enemies of this species are presumably as numerous, if not more, than those of the apple-tree tent caterpillar. William Saunders cites an instance in which a black-billed cuckoo, *Coccygus erythrophthalmus* Wils., was brought to him with its crop filled with the caterpillars. It is quite probable that many other birds feed upon this insect, possibly more than on the apple-tree tent caterpillar, but no such records have come to my notice. The common toad has been recorded by Mr Kirkland as

feeding on this species, though from this batrachian being confined to the ground and occurring more abundantly in cultivated fields, it is hardly probably that as a rule it devours many of the caterpillars.

Remedies and preventives. When this species appears in orchards or attacks a few cherished trees on the lawn or elsewhere, most of the methods recommended for the apple-tree tent caterpillar can be employed against it successfully. The difficulty is not so much in controlling this insect in the fruit orchard and on highly valued trees, as in the forests. The ravages in the wood lands and the extensive sugar orchards can rarely be successfully met by the foregoing methods. In these localities the expense attendant upon the collection of the egg belts or spraying the trees with poison would be prohibitive in most instances. In a general way, recourse must be had to preventive measures. Our native insectivorous birds should be protected from hunters and encouraged in every possible manner. Their efficient services alone should do much to abate the nuisance. The insect enemies of this species should be preserved from destruction whenever possible. In case of very severe outbreaks, such as have occurred this year and last, it may be found advisable to burn over the defoliated areas just after the caterpillars have pupated, and before the moths emerge, provided there is not enough inflammable matter on the surface to produce a fire that would seriously injure the trees. The burning would have to be conducted with caution, but wherever practicable, it would result in the destruction of many insects.

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MAMESTRA PICTA Harris

Zebra caterpillar

Ord. Lepidoptera: Fam. Noctuidae

The larva of this species has gained for itself a very unsavory reputation among agriculturists on account of its numerous depredations on various garden crops, it being particularly fond of cabbage and related plants, sometimes proving very destructive to them. The present season its previous records appear to be outdone by its occurrence in large numbers on timothy hay put into the barn the previous day.

Remarkable demonstration. The following inquiry was received from a correspondent of the *Country gentleman*:

I have just finished cutting a 20-acre lot of timothy hay, and put it in the barn yesterday. This morning on going into the barn we found the hay literally covered with caterpillars, say from $1\frac{1}{2}$ to $1\frac{3}{4}$ in. long, of a very bright yellow color, with a black stripe from head to tail; head red. Can you tell me what they are? Would you use the hay? We did not see them in the field, but the barn is alive with them.

Alexandria Bay, N. Y.

W. C. B.

The following reply to the question in regard to the value of the hay for feeding purposes was made:

It is most probable that the caterpillars observed had been feeding on the grass and were accidentally taken up with the hay. Their appearance in such large numbers on the mow indicates that the majority will work their way out and leave the hay, since it is probably too hard and dry to be acceptable provender. So long as the hay retains its normal sweet odor, even though a dead caterpillar be seen here and there, it would be perfectly safe to feed out; but if the dead bodies are numerous enough to contaminate it, and impart a foul odor, it would be safer to use it for some other purpose.

In a subsequent letter with the examples requested, in order that the identity of the species might be established, Mr Browning stated that last year these larvae entirely destroyed his crop of oats on the 20 acres above mentioned, and that so far as his observation went, they were confined entirely to that one field. While it may be very proper to question whether it was the larvae of *Mamestra picta* that caused this enormous damage to the oats, still the weight of evidence indicates that this species

was the depredator. The well known, almost omnivorous habits of the larvae and their abundance at the present season in the same field throw a very strong suspicion on these caterpillars.

Description. The eggs are deposited in patches on the under surface of the leaves, according to Prof. Davis. He also states that a moth usually lays from 125 to 150 eggs, though he obtained one cluster of 452. The young larvae probably vary somewhat in appearance. Dr Packard describes them as pale greenish, with four dark stripes on each side. Dr Riley states that at first they are almost black, though they soon become pale and green, while Prof. Davis found them to be 'hairy, speckled, white caterpillars, with a black head and black crescent on the thorax.' After the first molt, the appearance of the larvae is much the same as when matured, according to several writers. In the earlier stages, the black dorsal stripe is divided by a median white line and the proportionate amount of black is much less than when the larvae are nearly mature. The brilliantly colored larva is from $1\frac{1}{2}$ to 2 inches



Fig. 11 MAMESTRA PICTA: a, larva; b, moth (after Riley).

long when full grown, and may then be recognized by its broad, jet-black dorsal stripe. The two bright yellow stripes on each side are separated by a broader black area, which is broken by numerous transverse, irregular, white lines (fig. 11 and pl. 5). In Dr Lintner's detailed description of this larva (see citation), he compares the broken, black stripe to a series of letters: IVNW. Beneath the lower yellow line there is more or less black, broken by irregular white lines, somewhat as in the lateral black stripe above. The head and legs are brick red.

The pupa has been described by Dr Riley as about ' $\frac{3}{4}$ of an inch long, deep, shiny brown, and thickly punctate, except on the posterior border of the joints, and specially on those three immediately below the wing sheaths, where it is reddish and not polished ; it terminates in a blunt point ornamented with two thorns.' Pupation occurs underground, in a rude earthen cell, which is lined with particles of soil interwoven with silken threads.

The front wings of the moth are of a beautiful, rich purple-brown, blending with a delicate lighter shade of brown in the middle. The ordinary spots in the middle of the wing, with a third oval spot, more or less distinctly marked behind the round one, are edged and traversed by white lines so as to appear like delicate net work ; a transverse, zig-zag, white line, like a sprawling W, is also more or less visible near the outer edge, on which edge there is a series of white specks ; a few white atoms are also sprinkled in other places on the wing. The hind wings are white, faintly edged with brown on the upper and outer edges. The head and thorax are of the same color as the front wings, and the body has a more grayish cast (Riley).

Life history. The young larvae may be found in clusters on their food plants. As they increase in size, they disperse, till when full grown they are found singly here and there. When disturbed, they curl up and drop to the ground as do many cut-worms. In confinement they have been observed to eat with great rapidity, resting frequently from their feeding. The first brood of larvae mature in this latitude the last of June or in July. Those received from Alexandria Bay, July 19, were about full grown, while Dr Lintner records pupation of some reared examples on the 27th of June. The moths from these pupae emerged August 11 to 18, and deposited eggs, the earliest of which hatched August 20. Thus it will be seen that there are two broods in this state. Adults emerging from pupae the latter part of May, lay eggs which produce the brood of larvae usually destructive. The moths of the second generation fly in August, the larvae from their eggs attaining full growth in September or October and wintering as pupae. Like cabbage, one of its favorite food plants, the larva can withstand a considerable degree of cold, as recorded by Walsh.

Food plants. The larvae of this species have been previously recorded as feeding upon the following plants by various writers: Cabbage, cauliflower, turnip, rutabagas, mignonette, sweet pea, orange, clover, bean, pea, apple, currant, carrot, celery, white berry or snowberry (*Symphoricarpos racemosus*), honeysuckle, burdock, aster, cranberry,

potato, beet, spinach, lamb's quarters (*Chenopodium album*), smartweed, buckwheat, willow, spruce, asparagus and corn.

Though the insect is not abundant on all the plants mentioned above, and probably feeds on certain of them only under exceptional conditions, yet the list is so extended, including 29 species or varieties and representing 18 natural orders, that it is very difficult to say what the caterpillars will not attack. It is probable that farther study would show that the larvæ feed on a number of other grasses besides those recorded at the beginning of this notice.

Distribution. This insect appears, from the record of its injuries, to be widely and generally distributed over the United States and the southern part of Canada. Its depredations have been reported from most of the eastern states from Massachusetts to Florida, in many of the central and western states, and in southern California and the state of Washington.

Natural enemies. Several parasites have been reared from this insect. *Ophion purgatum* Say has been bred from this species by Mr Caulfield. As this parasite is one which has been found attacking the army worm, *Leucania unipuncta* Haw., in numbers, it is of importance to know that it also preys on this species. *Limneria annulipes* Cres. has been reared from this Mamestra (*Insect life*. 1890. 3:17). Another parasite which has been bred by several observers, is *Microplitis mamestrae* Weed. It has the peculiar habit of attaching its brown, ribbed cocoons between the anal prolegs of its victim. *Telenomus heliothidis* Ashm. has been reared from the eggs of this insect by Prof. Davis, who found that it destroyed from two thirds to three fourths of most clusters. Dr James Fletcher has reared two egg parasites, a *Trichogramma* and another black Proctotrypid, in large numbers. Prof. Davis also records an attack on the eggs of this species by two insects. The adult of *Megilla maculata* DeGeer devours the eggs, shell and all, while the tarnished plant bug (probably *Lygus pratensis* Linn.) sucks out the contents and leaves the shell nearly entire. The common toad is reported by Mr Kirkland as feeding on the caterpillars.

Remedies. The gregarious habits of the young caterpillars render their destruction by hand picking comparatively easy. They can be killed by spraying with paris green and water, at the rate of one pound to 150 or 200 gallons. In cases where it is undesirable to poison their food plants, the caterpillars can be controlled by the use of fresh pyrethrum, hellebore or kerosene emulsion.

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XYLINA ANTENNATA Walker^a

Ord. Lepidoptera : Fam. Noctuidae

The extensive defoliation of soft maples by the larvae of this species at Schenectady and presumably at other places in the state, is another instance of how destructive comparatively unknown species may become, provided conditions are favorable.

Recent injuries. The numerous soft maples at Schenectady were practically stripped of their foliage by hordes of light green caterpillars. On June 20, many were to be seen on the affected trees, not infrequently 50 to 100 on a single trunk. On the sidewalks, along the curbing and in the roadway, larvae were crawling hither and thither. Even were one

^a Determined by Drs H. G. Dyar and J. B. Smith.

deprived of sight, the peculiar odor arising from the thousands of larvae gave ample evidence of their presence, and the abundance of the caterpillars called to mind, forcibly, the numerous fields swarming with army worms in 1896. At Albany, only 17 miles distant, there was no sign of injury to the soft maples. A search at that time was not rewarded by a single caterpillar. As far west as Herkimer, on the Mohawk river, on the Raquette river in St Lawrence county, and in Schoharie county, many soft maples were defoliated. In some cases this was probably the work of *Xylina* larvae, though the forest tent caterpillar, *Clisiocampa distria* Hübn., was abundant and may have caused the mischief. In Massachusetts a green larva was quite destructive to soft maples, as stated by Mr R. H. Cooley. This depredator may be the same species that proved so destructive in New York. In a letter referring the larvae to *Xylina*, Dr Dyar states that in 1897 they were quite common on maples at Bellport, L. I., but less abundant, though plenty, the present season.

Comparatively unknown. An examination of the literature relating to this insect shows that it is comparatively unknown to economic entomology, specially as a defoliator of maple or other trees, though Dr Riley, in his 3d report on the insects of Missouri, states that for several years he had known the larvae to be common on apple, poplar, hickory and some other trees, the leaves of which they devour. This species, in conjunction with *Xylina laticinerea* Grote and *X. grotei* Riley, was reported in 1896 by Prof. Slingerland of the Cornell agricultural experiment station, as quite injurious to fruits in the state, more specially in the western part. Extensive injuries to apples in Orleans county, N. Y., were also reported to Dr Howard the same year. Previous to that, there had been but one record of injuries in New York by this species and that was in 1877. In other states there have been, a few instances of these insects attacking fruits. In 1870, Dr Riley received several complaints of injury by the larvae of this insect to peaches and apples. In 1888, it was somewhat injurious to apples and a bulletin by Prof. F. H. Hillman, of the Nevada agricultural experiment station, records serious injuries in 1890 to roses by the same insect.

Description. The larvae of this species are stout, smooth, light green, cutworm-like caterpillars measuring from 1 to 1½ inches in length when full grown. The head is pale yellowish green. There is a rather broad yellowish white or white dorsal stripe along the body, a narrower white sub-dorsal stripe, a broken, faint lateral stripe of the same color and an irregular white stigmatal stripe. The tubercles are rather large

and white, and the skin is minutely spotted with the same color. Prof. Slingerland (see citation) states that in the larvae of *X. grotei* both edges of the stigmatal stripe are well defined, while in those of *X. antennata* the upper edge is much broken or indented. He finds that the sub-dorsal stripe is more continuous in the latter, it being composed of three or four irregular spots on each segment in *X. grotei*. He separates the larvae of *X. laticinerea* from those of *X. antennata* by the position of the stigmatal stripe, which is just above the spiracles, except the one at each extremity, in the former species, while in the latter it is mostly below the spiracles.



Fig. 12 *XYLINA ANTENNATA* (original).

The moth (fig. 12) is ashy gray with indistinct, rather variable markings. Sometimes it resembles *X. laticinerea* so closely that only an authority on the family can separate the species. So close is the resemblance between these forms, that at first the larvae depredating on the maples were referred by Dr Dyar to *X. grotei* and *X. laticinerea*, the determination being based on examples named by Dr Smith some years ago. The subsequent studies of the latter have somewhat modified his views as to the limitation of these species, and have led to a renaming of those at the U. S. National Museum. These forms are undoubtedly very close to each other, though Prof. Slingerland has found differences in the male genitalia of *X. antennata* and *X. grotei*.

Definition of the species. In opposition to this view, Dr Riley regarded the above-named forms as but varieties of the species under discussion.

Writing of this family in 1871, he states that great variability is characteristic of these moths, that only the more strikingly marked should be described, and adds that no doubt many of the so-called species will turn out to be but varieties. In a communication from Prof. G. H. Hudson of the State normal school at Plattsburg, N. Y., he writes: 'After some years of trial and with over 800 specimens for comparison, I have come to the conclusion that *Xylina antennata*, *X. laticinerea* and

X. grotei are one and the same species.' Differences in the time of flight have been observed by Prof. Hudson in the case of closely related species, as, for example, *Eyprepia virgo* Linn. and *Eyprepia parthenice* Kirby, their periods being well separated except for a few stragglers. The same he found true in the case of *Feltia herilis* Grote and *Feltia subgothica* Haw., but not so with the species under discussion. During several years of collecting, Prof. Hudson has taken these moths (*X. antennata*, *X. laticinerea* and *X. grotei*) from Sep. 25 into early November, they being most abundant from the last of September throughout October, and from March 2 to May 2, occurring in the spring in greatest numbers from about March 20 to April 13. He also writes: 'I have taken specimens at sugar while the grass and pools of shallow water were freezing at my feet. The moths probably kept in the warmer upper layers. I have taken them when the temperature 6 feet from the ground was but 3 degrees Centigrade but never below this. On one of these occasions, a very light snow was falling, yet I found a single specimen feeding at sugar at 6.30 p. m. This was on April 2, 1889.'

Life history. Usually the larvae are not observed till May or June. They complete their growth by the middle of the latter month, enter the ground and pupate an inch or more below the surface. They remain in the quiescent stage till September, when most of them emerge. Though some hibernate as pupae, the majority pass the winter as adults. It has been stated that in the south, the eggs are deposited on the under surface of the leaves. No record of the oviposition in the north has been made.

Food habits. Though comparatively little is known about the food habits of this species, it is probably a somewhat general feeder. Dr Riley records attacks by the larvae of *X. antennata* on apples, peaches, oak galls, hickory leaves and those of other forest trees. Their feeding upon rose buds and maple foliage has already been mentioned. The extensive defoliation of the soft maples would indicate, however, that the species becomes abundant only when climatic and other conditions favor its rapid development upon some favorite food plant like the soft maple. In his bulletin, Prof. Slingerland adds peas, plums, currants and quinces to the list of fruits injured and states that one grower had to watch the buds on grafted pears to prevent their being destroyed.

Farther observations may greatly extend the list of known food plants.

Natural enemies. Two hymenoptera, *Mesochorus agilis* Cres. and *Meteorus hyphantriae* Riley, were reared from *X. laticinerea* by Prof. Slingerland. They would probably attack *X. antennata* with equal readiness.

The latter parasite is a very efficient enemy of the fall web worm, *Hyphantria cunea* Drury. In addition to these, I have reared examples of the red-tailed tachina fly, *Winthemia 4-pustulata* Fabr., a species which has frequently rendered most valuable aid in controlling the army worm, *Leucania unipuncta* Haw.

Remedies. In most cases the parasites and the native birds will keep this species under control. The outbreak chronicled in the preceding pages is out of the usual order and may not occur again for years. In such event, resort may be had to spraying the infested trees with the arsenites. If the application is made before the caterpillars are more than half grown, serious injury to the trees may be averted. If the spraying is impracticable, many of the descending caterpillars can be killed by inclosing the trunks of the infested trees with a low overhanging barricade and then treating the collected larvae with hot water, kerosene emulsion or other contact insecticide. Small trees can be protected by jarring the caterpillars from them, and if sticky bands are placed around the trunk no larvae can ascend to continue their destructive work. In fruit orchards, as pointed out by Prof. Slingerland, spraying before the fruit appears or jarring are about the only measures that can be relied upon in combating these pests.

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LECANIUM TULIPIFERAE Cook^a

Tulip-tree scale

Ord. Hemiptera: Subord. Homoptera: Fam. Coccidae

The tulip-tree is commonly unaffected by insects, but in this large species of *Lecanium* it finds an enemy that occasionally causes considerable injury. Several twigs from a tulip-tree, showing a very bad condition of affairs (fig. 13), were received on October 11, from Mr Alfred Pell, of Highland Falls, N. Y., with an inquiry as to the nature of the attack. The insects were so crowded on portions of the bark, that the old scales were huddled together and badly deformed. Under a lens it was seen that thousands of young had established themselves in the immediate vicinity of their parents, almost covering the bark in many places (fig. 14), while a few occurred along the veins of the leaves. The young were still issuing from the parents, as a number of paler individuals were to be seen crawling over the twigs. Branches of *Magnolia soulangeana* badly infested by this species have also been received recently from Fishkill-on-the-Hudson.

Earlier injuries by this species. In 1878 this scale insect was mentioned by Prof Cook as one that frequently destroys tulip-trees in

^a Referred to *L. tiliae* Fitch by some authors.

Michigan. He states it was so abundant in 1870 on the college grounds at Lansing, Mich., that some of the trees were killed outright and others much injured. In the *Rural New Yorker* of May 10, 1890, a more



Fig. 13 LECANIUM TULIPIFERAE (original).

serious outbreak of this species is recorded at River Edge, Bergen county, N. J. Three years before, the tulip-trees in that vicinity were attacked by this scale insect, and at the time the notice was written, not only had trees in front yards been rendered worthless, but the lower branches of those growing wild had been killed. Serious injuries to tulip-trees in 1896 at Hartford, Ct., have been reported by Dr Sturgis, of the Connecticut agricultural experiment station, and Dr J. B. Smith, of the New Jersey agricultural experiment station, the same year observed a serious attack by this insect in his state.

Description. The adult females are among the largest of those belonging to the genus. Some received measured $\frac{3}{10}$ inch in diameter. The scale is light brown, mottled with dark brown, and very convex. The under surface is concave, and in the examples before me, there are two pairs of ventral, transverse, white lines composed of short cottony filaments, one on each side near the middle and the oblique pair nearer one extremity, probably the anterior. Both are interrupted in the middle. The young at this time (October) range in color from a light brown to almost black. The abdominal segments are sharply defined, the caudal extremity is notched, and from the tips of the last segment there extends a pair of delicate filaments. The young have a general resemblance to tiny trilobites.

Life history. No signs of eggs were to be seen, though Prof. Cook describes them as small, yellow and oval. On examining the adults, a

number of young were found underneath. Apparently the species is viviparous in this latitude, as recorded of it farther south by Dr Riley. In Florida all stages have been observed during the winter, and it hiber-

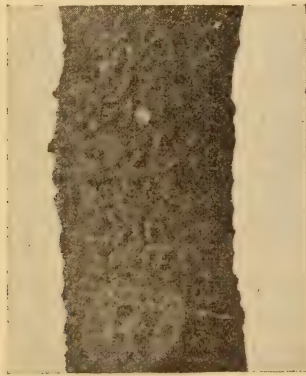


Fig. 14 Young of *LECANIUM TULIPIFERAE*, much enlarged (original).

nates as larvae at Washington, D. C., according to Dr Riley. The numerous young on the branches and those still issuing would indicate that the larvae must hibernate in this stage. The only observed difference in October between those which had issued some time before and those emerging, was in the color. The older ones still retained the larval form, but they had turned black, were closely applied to the bark and attached by a slender thread. In this condition they were apparently ready for hibernation, since upon being disturbed there was no effort to move off, as in the case of younger individuals.

In this latitude there is probably but one annual generation, as there is little chance that young would be produced earlier here than in Michigan. Prof. Cook states that they appear late in August.

This insect produces a large amount of honey dew, which has a nauseating odor. It has also been observed on clover by Prof. Cook. A parasite, *Coccophagus flavoscutellum* Ashm., has been reared from this scale insect (Howard, see citation).

Remedies. In case of a bad infestation, it would be well to scrape all the old insects from the branches in the autumn, and then treat the infested limbs with either whale oil soap or kerosene emulsion. If this is undertaken before many young have emerged, the trees should be nearly freed from the pest.

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LEPISMA DOMESTICA Packard
Bristle-tail; Fish-moth

Ord. Thysanura : Subord. Cinura : Fam. Lepismidae

The so-called bristle-tail, fish-moth, silver-fish, etc., *Lepisma saccharina* Linn., is a rather common insect about houses, though it is rarely seen. The work of this insect and the allied *Lepisma domestica* Packard is often seen among books and papers that have been allowed to remain undisturbed for a number of years. These insects have a liking for paper, specially the heavier grades, starch, paste, etc. They have even been

known to cause the wall paper in a house to scale off by feeding on the starch paste. In museums they are frequently troublesome on account of their habit of eating away the surface of the labels. In one case coming under my observation at Fort Plain, N. Y., the labels were so badly eaten as to be illegible in a number of instances, and in one or two cases the fragments dropped from the blocks to which they had been tacked. These insects even worked their way into wooden boxes containing microscopic preparations and attacked the labels gummed on the glass slips. Another instance of their destructiveness is shown in the accompanying reproduction from a photograph of a senate bill, which had been undisturbed in the office for about 16 years (fig. 15). It is most probable the work of *Lepisma domestica*, as it has subsequently been taken in the office. Both of these species

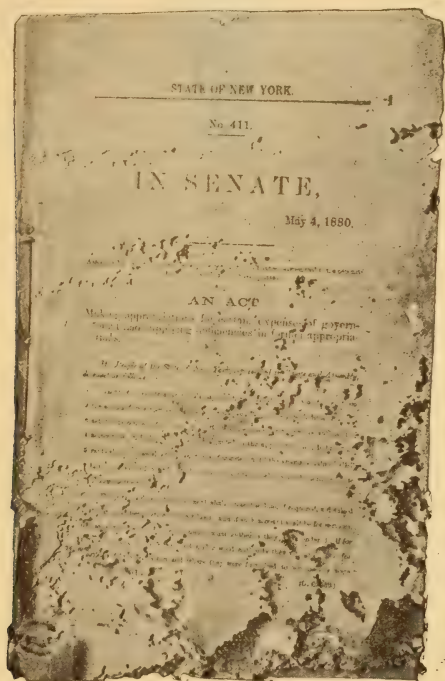


Fig. 15—Work of *LEPISMA* (original).

are small and shun the light, running very rapidly to a place of concealment on the slightest alarm. They are slender, silvery gray, wingless insects, belonging to the lowest order, Thysanura. Their long, fragile antennae and delicate anal filaments render it very difficult to capture a specimen unbroken. *Lepisma domestica* is represented very much en-

larged in the accompanying figure. This insect is found so generally distributed over houses that it is difficult to use insecticides against it successfully. Fresh pyrethrum kills it readily and may be used wherever



Fig. 16 *LEPISMA DOMESTICA* (After Marlatt: U. S. Dep't agriculture, Division entomology, Bulletin 4).

practicable. As a rule not much damage is done except in rather moist situations or where objects are undisturbed for a series of years, as in the case of the senate bill illustrated above.

The following are the principal references to this species.

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EURYPELMA HENTZII Girard*Molting of a Tarantula*

Class **Arachnida** : Ord. **Araneida** : Fam. **Theraphosidae**

Though not of economic importance and a native of the southern states, this spider has excited so much popular interest that it is deemed worthy of a brief notice.

This large female tarantula, a gift to the division by Dr J. M. Bigelow of Albany, came into my custody last January. For the preceding two years, she had been kept as a pet by her owner, he having secured her from a dealer in bananas and other fruits. At the time the spider came into the doctor's possession, she was nearly half grown. About the latter part of 1896, she molted or cast her old skin, which is in the state collection.

Habits. Though this and related species are said to prey upon insects and other small creatures, this specimen attacked none of the cockroaches and other forms put into her cage or manifested any interest in them during the early part of the year. Meat placed in her cage was apparently untouched. A banana skin excited some attention, but there were no signs of her feeding upon it. Apparently, she had taken only large quantities of water during the first half of the year, though much that was put into her cage must have evaporated. Sometime after molting, she devoured a large piece of fresh meat with great eagerness and subsequently has taken it readily every few days.

Molting. On July 21, the tarantula shed its skin for the second time since it has been in captivity. Those familiar with insects, spiders and related creatures, are aware that they are incased in a hard, more or less unyielding integument. Increase of size is permissible only when the old skin is shed and one that has been newly formed beneath expands to the requisite degree. This is a process constantly occurring in nature and ever excites interest in the beholder. When a large spider, three inches long, throws off the old integument, it is a thrilling sight. In the present case the tarantula had evidently been feeling unwell for some days, a condition frequently preceding this process among insects, and that morning she was found lying on her back and apparently dead, but moved a little upon being disturbed. She lay thus till about quarter past twelve when the rustling her movements made excited attention. The old skin had then ruptured around the thorax in such a manner that the top could be removed entire and through this opening the giant spider was literally working out of her old skin (see plate 6.) This was accomplished by the aid of the eight legs and the two leg-like

palpi. At the end of an hour the change had been effected. The spider lay upon her back, beside the perfect skin, resting from the severe exertion.

Some idea of the perfect condition of the skin may be obtained from plates 6, 7, which is a reproduction from photographs of the dorsal and ventral surface of the exuvia. The dorsal aspect (see plate 6) shows very plainly the coxal cavities (*c*) and the line of rupture of the cephalo-thoracic dorsal piece (*a*), which was laid back and to one side in order to give a fuller representation of other parts. The more delicate abdominal covering (*e*) was torn a little during the process of molting and more when the skin was mounted. The position of the eyes (*b*) is shown very nicely on the dorsal covering of the cephalo-thorax. The poison fangs can be seen distinctly between the palpi (*f*) in the view of the ventral aspect (see plate 7). Their shiny black surface reflected so much light that they appear nearly white.

This tarantula was unusually large before she molted and is now of still greater size. An idea of the increase in size attendant upon molting may be gained by comparing the dimensions of the dorsal piece of the skin shed about the latter part of 1896 when under the care of Dr Bigelow and the one cast in July. The first measures 1 inch and the second measures $1\frac{1}{4}$ inches in length. Therefore, the present dorsal piece will probably be proportionately larger when fully expanded.

HINTS ABOUT INSECTICIDES

A knowledge of the life history and habits of most of our insects is at present limited to comparatively few species and the number of well-known forms will probably ever remain relatively small. In spite of this drawback, destructive insects must be controlled or crops will be ruined. In many cases very precious time is wasted if the owner of a field must submit examples of the depredator to an expert at the experiment station or elsewhere, in order to ascertain the proper remedy. While establishing the identity of an insect is extremely important, the farmer, whose corn is being devoured at the rate of an acre a day by the army worm, is more concerned to know the best methods of fighting the pest than to learn its scientific name. Though the injuries by insects are not always so striking as in the case of the army worm, the great advantage in controlling them at the inception of the attack can not be overestimated. It is a well-known fact that many insects succumb more readily to insecticides when young than later. This is not only true of scale insects, but applies to certain caterpillars and other forms. Though insecticides and their action have frequently been explained, the facts show, most conclusively great need of instruction in their use.

How insects feed. Before attempting to control an insect, we must first ascertain how it can be affected. The large amounts of paris green and similar substances used, at once suggest the idea of poisoning its food. But can the insect under consideration be killed in that manner? As paris green is effective only when taken internally, and is practically insoluble in water, it must be eaten with the food before the depredator can be killed. In other words paris green and similar poisons can be employed successfully against those insects only which bite off and swallow their food, and even then it is limited to cases where the poison can be applied to parts eaten. It is not enough to ascertain merely that the pest is one that devours, but the portion of the plant consumed must be known and the application made where it will be eaten. In the case of the apple-tree tent caterpillar, which devours the entire leaf, it makes little difference whether the poison be applied to the upper or under surface of the foliage, except that when on the latter it is less likely to be washed off by rains. It is a very important matter in the case of the elm-leaf beetle, whose larvae feed only on the under side of the leaves, rarely rupturing the upper epidermis, and for this reason poison applied to the upper side of the leaf would have little or no effect on them. Other biting insects are found in places where it is practically impossible to poison their food. Such are the leaf miners, tiny larvae that obtain all

their sustenance between the upper and lower epidermis of one leaf, the larvae tunneling apples and other fruits, or the borers in the trunks of trees,

The practical farmer or fruit grower soon learns that another class of insects is not affected by such internal poisons as have been mentioned. Each season several reports are received at my office stating that paris green has no effect when sprayed on trees infested with aphids or plant lice. The simple reason for this is, that these forms belong to a large class known as sucking insects, because they extract the fluids upon which they live through a delicate beak inserted into the tissues. Consequently particles of internal poisons lying upon the surface of a food plant have no effect, as the tip of the tiny beak is beneath the surface when the insect draws its fill. It is not difficult to recognize these sucking insects by their work, and one soon becomes familiar with their general aspect. They never devour portions of plants. The most common evidence of injury is the withering or wilting of either entire leaves or limited portions. A small lens will readily show whether the injury is due to a biting or sucking insect. Some of the more common species falling in this latter class are all plant lice, scale insects and the larger forms like the squash bug, the four-lined leaf bug and their allies.

Operation of contact insecticides. As a rule it is best to protect a plant by applying paris green or other poison to its foliage, provided the insect is one that devours. Otherwise, recourse must be had to contact insecticides, that is, to substances that will kill an insect when brought into contact with it. None of those commonly used are so deadly to insect life, that they will kill by simply touching the victim, at a single point. They operate by closing or choking the breathing pores or spiracles, along the sides of the caterpillar, or they may exert a paralyzing influence through these orifices. Therefore it will be seen at once that success will be in proportion to the thoroughness with which the treatment is performed. Insects not hit by the contact insecticide are unharmed, those barely touched, if affected at all, may recover. Only those well covered with the substance succumb. It is by no means easy to secure the desired results, even with the aid of a good spraying apparatus. Some insects take flight so quickly that it is practically impossible to hit many with a spray. Among these are the small leaf hoppers which are sometimes very injurious to certain plants, and about the only way they can be killed is by catching them on sticky fans or screens carried between the rows. Many plant lice secrete a woolly substance which serves to protect them from the action of insecticides. The drop of honey dew on the young pear psylla and the hard covering of many scale insects serve the same purpose. The attacks of some plant lice cause the leaves to curl and thus they are protected from deadly sprays.

It will be readily seen that the correct application of an insecticide involves a number of considerations. If it is not done properly the effort is useless, and money is lost in the labor wasted and on the poor crop resulting.

Useless remedies. Avoid patent remedial preparations, specially those that are advertised to kill most, if not all insects, and act as a fertilizer in the bargain. A large corps of trained workers in experiment stations and other public positions are at present engaged in searching for new insecticides and in determining the best methods of applying them. Recommendations from such sources can usually be relied upon. Some of the preparations sold in the markets undoubtedly are of value, but they owe their efficacy to well-known substances and not to certain secret compounds. The great objection to this class of insecticides is that the farmer pays several times the value of the article, because it is in a disguised form, and he is usually ignorant of its nature. There are other remedies which are totally worthless, having no intrinsic value of themselves. One of the most persistently advertised of these is the old trick of plugging a tree with sulfur or other substance in order to render the sap distasteful to insects of all kinds. This is a fascinating theory, but has absolutely no basis in fact. The safest way is to disregard all innovations till they have been duly tested at experiment stations or by other known authorities.

Preventives. The old proverb, 'An ounce of prevention is worth a pound of cure,' is most emphatically true in controlling insects. Unfavorable weather, a rush of work or other causes may enable an insect to commit serious injuries before it can be stopped. Repeated rains frequently cause postponement of spraying. It is well known that the period of greatest insect activity is also the time when farmers have the most work on their hands. Another noticeable fact is that the man who practises a wise rotation of crops, keeps his orchard clean and allows no rubbish and brush along the fences, is the one who seldom bemoans loss from insects. It has also frequently been observed that healthy, vigorous plants suffer less from insects than those in a sickly condition. In other words, clean culture with abundant plant food, and a rotation of crops are the best checks upon the undue increase of insect pests.

Need of experiment. The following formulas comprise what are regarded as the most reliable, but must be modified under varying conditions, to meet the demands of the occasion. It should be borne in mind that in many cases it is not so much the insecticide used as the manner of its application, though in some cases the difference is due to a variation in composition. For example, one man will use paris green and not

london purple and another the reverse. Yet both have been the object of considerable experimentation and are of nearly equal value, though the latter is said to be more variable in composition. The same may be said of kerosene emulsion and a whale oil soap solution. In the case of these preparations, it is always advantageous to make a few tests. To a certain extent a man may depend upon the experience of others, but he should also ascertain by trial what proportions, with his own apparatus and under the conditions at hand, will give the best results.

Arsenical compounds. These are effective against insects which devour portions of a plant and of value only when placed where they will be eaten. The following formulae are commonly employed :

Paris green	1 pound
Quicklime	1 pound
Water.....	100-300 gallons
London purple	1 pound
Quicklime	2-3 pounds
Water.....	100-300 gallons

The more common proportion is at the rate of 1 pound of the poison to 150 or 200 gallons of water, and less should be used on the more tender foliage like that of the peach or there may be serious injury. The addition of lime is not necessary, specially with paris green, but is a wise precaution as it neutralizes any free arsenic acid and thus prevents burning. Paris green can be applied with the bordeaux mixture,^a at the rate of 4 ounces of the poison to 50 gallons of the fungicide, and in this preparation both fungi and many insects find an effective check.

If desired, paris green or london purple can be dusted on low plants, such as potatoes and asparagus, when they are wet with dew, provided the poison is diluted with from 50 to 100 parts of flour or land plaster.

Another substance which has received high praise and may come into general use after its good qualities become better known, is the arsenate of lead. The value of this compound as an insecticide has been

^a The following formula is taken from *Bulletin 114, Cornell university agricultural experiment station* :

Normal or 1.6% Bordeaux mixture :
 Copper sulfate, 6 pounds
 Quicklime, 4 pounds
 Water, 40-50 gallons.

Dissolve the copper sulfate by putting it in a bag of coarse cloth and hanging in a vessel containing at least 4 gallons of water, so that it will be just covered. Use an earthen or wooden vessel. Slake the lime in an equal amount of water. Then mix the two and add enough water to make 40 gallons. It is then ready for immediate use. If the mixture is to be used on peach foliage it is advisable to add 2 pounds of lime to the above formula.

brought out by numerous experiments, made in the extensive work against the gypsy moth. One advantage is that it can be applied in very large quantities without injuring the foliage. When properly prepared, it remains for some time suspended in the water, imparting a milky color, and also adheres to the leaves much longer than either paris green or london purple. Its whiteness is another advantage, because of which, it is readily detected upon green foliage.

In order to obtain the best results, the poison should be prepared just before using, by dissolving 11 ounces of acetate of lead (sugar of lead) in 4 quarts of water in a wooden pail, and 4 ounces of arsenate of soda (50 %) in 2 quarts of water in another wooden pail. As the acetate or sugar of lead dissolves rather slowly in cold water, the process can be hastened by using warm water. The resulting solutions should then be poured into the spraying tank containing enough water to give the desired proportions. In most cases this will mean turning them into 100 or 150 gallons of water.^a

Experiments by those connected with the gypsy moth work and others show that it can be applied in almost any proportion without injuring even the most delicate foliage. In cases where the insect is able to resist the action of considerable poison, as the gypsy moth and canker worm, or where the insecticide must remain on the trees for a considerable length of time in order to be most effective, as in the case of the elm-leaf beetle, or where the delicate foliage prohibits the use of sufficient paris green or london purple, the arsenate of lead will be found invaluable.

One objection to this substance, is the variable composition of the chemicals from which it is prepared. If either is in excess, it should be the lead salt, because that will not injure the leaves. A simple test^b for soluble arsenic acid, is the addition of a few drops of lead acetate (sugar of lead) solution to a filtered portion of the arsenate of lead solution. A white precipitate indicates the presence of soluble arsenic and more lead acetate (sugar of lead) should be added, or the foliage will be burned by the arsenic.

Compounds of arsenic can not only be sprayed upon foliage, but they can also be used most successfully in the preparation of poisoned baits, specially for cut worms, the army worm and grasshoppers. Fresh clover or other attractive food is dipped in water and paris green, using considerably more poison than when spraying, and bunches of it are distributed over the infested fields. Some form of a mash as, for example, one composed of 1 pound of paris green to 50 pounds of bran, well

^a Proportions recommended by Dr C. H. Fernald.

^b Smith, F. J. *Mass. Board of agriculture on gypsy moth. Report*, Jan. 1898, p. 67.

moistened, has been found very effective against cut worms. Some prefer to sweeten it with cheap sugar or molasses, specially for grasshoppers. The disadvantage of the mash is that it soon dries and then is of no value. In experiments against cut worms in onion fields, Mr Sirrine found that either dry bran and paris green in equal parts or 20 pounds of middlings to 1 pound of poison was a very effective bait.

Internal and contact insecticides combined. Hellebore and tobacco may act either internally or kill by contact. One ounce of fresh white hellebore thoroughly mixed in 3 gallons of water is a proportion recommended by Lodeman and Gould,^a while Dr Smith gives 1 ounce to 2 quarts of water. It may be applied pure or mixed with plaster or flour if desired. It is used largely against currant worms, specially when the presence of nearly mature fruit prohibits the application of paris green.

A strong decoction of tobacco may be prepared by boiling stems and other refuse till a deep brown extract is obtained. A few trials will enable one to ascertain how much this can be diluted and still be effective. It may be used successfully as a contact insecticide against soft bodied insects like plant lice, saw fly larvae and others, and it may also serve as a repellent or poison when applied to plants for the purpose of protecting them from attacks by flea beetles, and many other insects. If in the form of a fine dust, it is a very effective contact insecticide, and may be used with great advantage on the surface or worked into the ground around trees infested with root lice and other subterranean insects. In greenhouses it is very valuable, when stems or leaves are laid around, specially on the heating pipes, as its odor seems to be unfavorable to insect life. There is no easier method of keeping plant lice under control in a conservatory than by fumigation with tobacco smoke.

Contact insecticides. The most important of those commonly used are kerosene emulsion, whale oil soap solution and pyrethrum.

The standard kerosene emulsion is prepared as follows:

Hard soap	$\frac{1}{2}$ pound
Water	1 gallon
Kerosene.....	2 gallons

Dissolve the soap in boiling water and while still hot add the kerosene and emulsify by passing it rapidly through a force pump till it assumes a creamy consistency and oil does not rise to the surface. Dilute with 9 to 15 parts of water. In limestone regions where hard water is the rule, better results will probably be obtained by using the sour milk emul-

^a Bulletin 114, Cornell university agricultural experiment station.

sion, which is simply 2 gallons of kerosene and 1 gallon of sour milk emulsified by churning or passing through a pump. Besides being effective against exposed insects on plants, successful experiments on white grubs infesting the lawn around the capitol at Washington, D. C., indicate that kerosene emulsion may also be used against subterranean insects. Though the usual strength recommended is 1 part of the standard kerosene emulsion to 9 parts of water, Mr Marlatt has shown that it may be applied diluted with but 4 parts of water with almost no injury to growing plants (*Insect life*. 1894. 7: 116, 117).

Machines now on the market are said to give a reliable water and kerosene emulsion, the two constituents being taken from separate tanks in the desired proportions and emulsified mechanically as they pass through the nozzle. Pure kerosene is also being recommended by some as an insecticide that can be applied to trees in a fine spray on a bright drying day, without serious injury. The results heretofore obtained by different experimentors have been so contradictory that this treatment can hardly be indorsed without qualification. The safest way, as stated by Dr Howard, is for each man to experiment in a small way before he sprays many trees with this substance.

For scale insects, whale oil soap may be applied in winter at the rate of $1\frac{1}{2}$ to 2 pounds in 1 gallon of water, as recommended by Dr Howard. For summer use the extreme strength is given by Dr Smith as 1 pound to 4 gallons of water.

Pyrethrum, Dalmatian or insect powder, when fresh, is a valuable contact insecticide. It is usually applied in the powdered form, is not poisonous to man or the higher animals, and is largely used for household insects, in greenhouses and small gardens. If desired, it can be diluted with flour, in which event it should be mixed and allowed to stand several hours before it is wanted, or it may be used in water at the rate of 1 ounce to 2 gallons of water, it either being boiled or allowed to remain some hours before application. If moistened and molded into cones, it may be burned with very satisfactory results, for the fumes, while not disagreeable to man, paralyze and kill many insects.

Sulfur is a valuable insecticide, specially against mites. In greenhouses it is often strewed on the heating pipes or scattered about the house, and in this way a mild fumigation is obtained that is quite effective in keeping the red spider under control. It is frequently used in poultry houses and applied to stock. Bisulfid of lime^a is said to be an even better remedy for mites. This is easily prepared by boiling together in a little water equal parts of sulfur and lime, till a brownish liquid results. Use at the rate of 5 pounds of sulfur and 5 pounds of lime to 100 gallons of water.

^a Marlatt, C. L. *Farmer's bulletin* 19. 1897. p. 11.

Fumigation. Carbon bisulfid and hydrocyanic acid gas are the two substances most frequently employed for killing insects within tight inclosures, though the fumes of burning sulfur or pyrethrum are also used to a slight extent. The proportion of carbon bisulfid recommended by Dr Howard, is 1 pound to every thousand cubic feet of space. The grain or other substance to be fumigated must be in a tight vessel or building and the chemical placed in shallow vessels near the top of the inclosure, because the heavy, poisonous vapor from this liquid descends rapidly. As carbon bisulfid is inflammable and its gas explosive, great care must be exercised that no fire is brought near during fumigation. The period of exposure to this insecticide should vary somewhat according to the mass treated. Grain in large bins should be subjected to its action for a day or two. As carbon bisulfid evaporates rapidly, treatment with it does not injure grain for food purposes and unless unduly prolonged, will not affect its germination to an appreciable extent.

This substance is also very effective against root-inhabiting forms. In the case of trees and vines, holes should be made with an iron bar about $1\frac{1}{2}$ feet apart and 1 foot deep over the area occupied by the roots, but no hole should be within a foot of the trunk. Use $\frac{1}{2}$ ounce^a of carbon bisulfid to each hole and close the top at once with soil. In the case of cabbage plants make a small hole $\frac{2}{3}$ inch from the plant and pour in a teaspoonful of the insecticide, closing as before. This chemical may be used against ants, it being advisable, as recommended by Dr Lintner, to cover the nest with a damp blanket, and at the expiration of a few moments the accumulated vapor under the blanket should be exploded by a light on the end of a pole. The explosion drives the fumes deeper into the nest.

The treatment of trees infested by scale insects with hydrocyanic acid gas has been carried on for some years in California. The introduction of the San José scale into many states east of the Rocky mountains, has led to fumigation being used to a greater or less extent in this region. By some it has been reported entirely effective and others have had different results. In most cases it will be found advisable to destroy young trees infested with the San José scale, though when large numbers are but slightly infested, thorough fumigation with hydrocyanic acid gas may be preferred. This treatment is also recommended for nursery stock showing the presence of other pests, as the more common scale insects, plant lice or aphids, pear psylla, apple-leaf *Bucculatrix* and other forms that are

^a The quantities and distances are those recommended by the Division of entomology, U. S. Dep't agriculture.

known to be injurious. Aside from the additional handling and the initial cost of the apparatus, the expense is but little. The value of the chemicals used has been estimated by Professor Johnson at not over 2 cents per 1000 nursery trees. The following formula is one commonly recommended^a:

Fused cyanide of potassium, 98% pure.....	1 oz. by weight
Commercial sulfuric acid	1 oz. by measure
Water	3 oz. by measure

The amounts given can be safely used on dormant nursery stock for each 100 cubic feet of space, as reported by W. R. Gunnis, chairman of the San Diego county board of horticultural commissioners (Howard, Bull. 3, U. S. Dep't Agr., Div. Ent. 1898, p. 60). Prof. Johnson states that repeated fumigation will not injure nursery stock and that if necessary the above amounts may be safely used to every 75 cubic feet of space.

If no San José scale is present, the above quantities should be sufficient for 150 cubic feet. Expose the stock to the action of the gas for one hour. It will be found necessary to construct some form of a receptacle in which to conduct the treatment. This may be simply a tight box that can be inverted and its edges banked with earth, or one with covers, or even a building or portion of one, as circumstances may dictate. It must be practically air tight, easily and quickly ventilated and the stock should rest on a grating or other support that will permit ready access of the fumes on all sides. The earth should be removed from the roots of the stock so far as practicable before fumigation. The gas should be generated as near the center of the lot to be treated as possible and in case of large amounts, several generators should be used and so placed that a rapid and uniform distribution of the gas will be insured. The cyanide must be kept in tight bottles in a safe place, as it is a volatile, deadly poison. The cubical contents of the fumigating chamber should be estimated, the cyanide weighed out in amounts sufficient for a treatment and put in paper bags. Pour the acid slowly into the water, stirring the mixture constantly, otherwise drops may fly and burn those in the vicinity. After the stock is properly arranged, pour the necessary amount of dilute acid into a glazed earthen vessel, place the cyanide while still in the paper bag into the acid and water, and close the fumigator. The advantage of putting the cyanide into the acid and water while still in the paper bag is that it prevents sputtering, which is

^aProf. W. G. Johnson, state entomologist of Maryland, as a result of a large series of experiments performed last year and the present season, recommends a slightly different formula. He advises the use of 1 ounce of cyanide of potassium, $1\frac{1}{2}$ ounces of the best grade of commercial sulfuric acid and $2\frac{1}{2}$ ounces of water to 113 cubic feet of space. In his experience, a more perfect reaction between the chemicals is obtained by modifying the formula as given above.

specially liable to occur when large amounts are used. Great care should be exercised in handling the cyanide, the acid, and in opening after fumigation. The substances used are deadly. Even a slight burn from sulfuric acid is very painful.

Recent experiments by Prof. Johnson show that in Maryland growing trees can be treated with this gas and every scale insect killed. The results obtained in some other eastern states are not so favorable, and, as an outfit for trees of any size is quite expensive, it is hardly probable that it will come into general use, unless it is undertaken by experienced persons who would go from place to place and fumigate wherever desired. It can be used to very good advantage in freeing greenhouses from animal pests of all kinds, and when it becomes better known may be more generally employed. In treating the various plants in greenhouses, the amount of gas necessary would not be so great as in the case of the San José scale. The formula given above would produce enough gas for at least every 150 cubic feet of space, and the action should not be continued over 30 minutes. Dr Jabez Fisher, of Fitchburg, Mass., recommends the use of this amount in greenhouses for from 1,000 to 2,000 cubic feet of space, allowing the gas to act all night (*American gardening*. 1898. 19:741).

NOTES ON SOME OF THE INSECTS OF THE YEAR IN
THE STATE OF NEW YORK^a

The present season has been characterized by the scarcity of plant lice, only one or two complaints being received, whereas in 1897, reports of injuries by these insects came from all quarters. The foliage of the forest and shade trees appears to have suffered more than usual. In Albany and other cities and towns in the state, the white marked tussock moth, *Notolophus leucostigma* Sm.-Abb., and the elm-leaf beetle *Galerucella luteola* Müller, have been more injurious than usual. In the rural districts the tent caterpillars have wrought havoc in orchard and forest.

Eriocampoides limacina *Retzius*. The cherry or pear-tree slug causes more or less injury from year to year in New York state, specially is this true of nursery stock. During the inspection of nurseries last autumn, indications of its presence on pear-trees was the rule and in some cases the foliage had been materially injured. Last June Thomas Tupper, of Corning, N. Y., reported a serious injury by this insect to both his cherry and pear trees.

Saw toothed grain beetle.^b The following interesting case of longevity in the adults of this species, *Silvanus surinamensis* Linn., is deemed worthy of record. May 26, 1896, examples of this minute beetle were brought into the office by Mr S. C. Bradt of Albany. After killing a few examples, the remainder were placed in a box with some flour in the hope that they would continue to breed. On August 26 of that same year, three individuals were transferred to clean flour in another box for the purpose of closer observation. Every few days or a week, the box was examined to see whether breeding had commenced, but no signs of increase were visible. Two were accidentally crushed July 31, 1897, which was over a year from the time they had been received and 11 months after they had been isolated. The remaining individual continued bright and active and finally disappeared between June 15 and 25, 1898. It had probably been allowed to escape by accident. This latter example had been under close observation for nearly 22 months, and since it was an adult when placed with its two companions in a separate box, it may have been several months older.

As a check upon this series of observations, seven beetles were confined with some samp in a tightly corked vial, Sep. 4, 1896, and notes were made of their condition. During the entire time there were no signs of

^a Read before a meeting of the Association of economic entomologists held at Boston, Mass., August 19, 1898. A few additions have been made.

^b Added subsequently.

breeding. On Aug. 30, 1897, but two of these beetles were alive and active. Between November 15 and December 9, one of these two died, but the remaining one is still bright and active at this date, Nov. 18, 1898, and has therefore lived for over 26 months under close observation with no better food than dry samp. The above record shows beyond doubt that these beetles can maintain life for long periods of time under comparatively unfavorable conditions.

Byturus unicolor *Say*. The latter part of May Dr Peck, state botanist, brought me several beetles belonging to this species, with the statement that from one to five were to be found in many of the opening buds of his raspberry plants where they were evidently feeding. This insect does not appear to have been noticed in the state since Dr Fitch gave a brief account of it in his 14th report for 1870, though Dr Lintner records in his 8th report for 1891, its receipt from New Haven, Ct., where it had been injuring leaves and buds of the raspberry.

Elaphidion villosum *Fabr.* Complaints of injuries by the oak or maple-tree pruner have come from several localities the present season. Serious injuries were reported to me from Lake George and also from Oakes, Ulster county, where its operations had been observed for several years past.

Galerucella luteola *Müller*. The prolificacy of the imported elm-leaf beetle was brought very forcibly before me by certain studies made in connection with the preparation of *State museum bulletin 20*. The last day of May, I captured two beetles well distended with eggs and determined to ascertain for myself the number they would produce. One was confined in a small, corked vial, and the other in a jelly tumbler. As might be expected, there was considerable difference in the number of eggs deposited, the former producing 431 and the latter 623. A portion of the discrepancy was probably due to disparity of conditions and the remainder must be attributed to a variation in capacity. In order to bring out certain points clearly, I have tabulated the record.

Record of eggs deposited by two elm-leaf beetles^a

FEMALE IN VIAL

FEMALE IN TUMBLER

DATE	CLUSTERS OF	TOTAL	CLUSTERS OF	TOTAL
June 1	(2)	29	(4)	42
June 2				
June 3	9, 9, 14	32	18	18
June 4				
June 5				
June 6	18	18	26, 21	47
June 7				
June 8	15	15	4, 26	30
June 8 (2 p. m.)	20	20		
June 9			27	27
June 10	20	20	3, 31	34
June 11	23	23		
June 12				
June 13	11, 13	24	3, 7, 8, 11, 15, 19	63
June 14	31	31		
June 15	16, 5	21	14, 27	41
June 16	28	28	30	30
June 17			32	32
June 18 (absent)				
June 19	26, 30	56	10, 26	36
June 20	2, 6	8	36	36
June 21	3, 18	21	6, 25	31
June 22	2, 20	22	4, 31	35
June 23	27	27	1, 2, 11, 7, 13	34
June 24				
June 25				
June 26				
June 27	5, 7, 9, 15	36	13, 21, 32	66
June 28 (dead)			(dead) 4, 17	21
		431		623

It will be seen that from June 1 to 11 there were usually deposited between 15 and 47 eggs every other day. The 12th being Sunday, I did not attend to the beetles, but from there being two or more clusters found with each on Monday, it is probable that one or more were deposited the preceding day. The record shows that from either the 12th or 13th there was a marked increase in the number of eggs laid till the 23d, there being, as a rule, from 8 to over 40 deposited daily. In the case of the one confined in the vial, the record shows a discrepancy, which is greater than the facts warrant. I was unable to attend to the insects on the 18th, consequently it appears as though two days during this period had been skipped by one beetle and one by the other, whereas it is probable that but a day passed without the beetle in the vial depositing eggs and that the other really presents an unbroken record in this respect. During this short period of 10 or 11 days there were deposited over half of the total number of eggs produced during the 28

^a The examinations were made as a rule, between 8.30 and 9 a. m., though occasionally, when eggs were seen in the afternoon, they were recorded at the time indicated in the table. The dates falling on Sunday are in italics and as a rule no observations were made then.

days a record was kept, the figures being 238 and 338, or an average of over 21 and 30 eggs per day respectively. The average numbers deposited during the first 11 days of the month are 14 and 18 respectively, which shows there was an increase of one-half or more in the case of each beetle after June 11. Those deposited after the 25th were apparently the last efforts of the insects to provide for the perpetuity of their kind, though the quality of the eggs had not deteriorated.

During the whole period the beetles were under observation, they consumed large quantities of foliage, comparatively speaking. Many leaves of the trees outside were also badly riddled by their feeding. If we consider for but a moment the relatively large bulk of eggs produced by the beetles, it is not surprising that they require a large amount of food. Without attempting to make precise measurements, it would seem that a cluster of 30 eggs would present, after deposition, a bulk about equal to that of the parent insect. If this be a fair estimate, they produced on the average from nearly one-half to nearly two-thirds of their bulk in eggs daily during the first 11 days in June and from the 12th to the 23d the daily average was from over two-thirds to an equal bulk. This rapid elaboration of eggs must make a large demand upon the system and require an abundant food supply.

Lest it be thought that the period of oviposition was abnormally prolonged, I would state that recently deposited eggs were to be found on the trees up to July 9. This record indicates most emphatically the value of spraying to kill the beetles, specially before they have reached the more prolific period mentioned above.

A few notes confirmatory of previous records concerning the life history of this insect in Albany and Troy will undoubtedly be of interest. The last of the overwintered beetles were seen early in July. On the 16th, recently transformed adults were easily found, and fresh eggs a few days later, either singly or in small clusters, indicated the beginning of oviposition by the second brood. On 12 August, Mr P. C. Lewis, who had charge of the spraying in Albany, informed me that the second brood of larvae had been quite injurious in certain parts of the city and that the beetles, ever on the watch for tender foliage, riddled the leaves very quickly. A visit to Troy on the 13th showed that practically the same conditions prevailed there. Soon after the foliage appeared it was attacked by the beetles and by the time the leaves were about half grown many larvae were to be found upon them. The injury to the elms in Troy by the first brood of larvae exceeded that of the preceding two years, because it was not only much more extended but the skeletonizing of the leaves was more thorough. As a rule all the European elms were practically defoliated. The same would have been true of Albany were it not for the spraying done.

An interesting feature in the latter city was the more extended injury sustained by the American elms. In Troy comparatively few of this species appear to have suffered much. The same was true of Albany two years ago. Last year considerable injury was inflicted and the present season much more in spite of the spraying. It should be stated that rainy weather just after the larvae hatched marred the efficiency of the work seriously. A few of the American elms in Albany have lost nearly every leaf and hundreds have been so affected that they present a more or less browned appearance. In Watervliet, where American elms abound, the ravages have been frightful, including practically all the elms.

Galerucella cavicollis *LeC.* In his 11th report Dr Lintner noticed this insect briefly and gave its earlier history. The species is one that is apparently changing its habits and becoming destructive. Mr Tupper, of Corning, N. Y., submitted examples of this insect and leaves from his cherry-trees, with the statement that they were injuring the trees seriously and might kill them. This is the second record of a recent attack on cherry in New York state by this species.

Notolophus leucostigma *Sm.-Abb.* The larvae of this species were unusually destructive in Albany this season. Not only were a large number of horse chestnuts defoliated, as frequently occurs from year to year, but many of the maples and lindens were seriously injured. On some trees the caterpillars were so abundant as to cause an unpleasant odor. It appears nearly impossible to secure adequate protection for trees along the streets, unless it is undertaken by the municipal authorities. The private individual who inquires what he should do to protect his trees after two-thirds of the foliage is destroyed, usually neglects to take proper precautions to prevent trouble another season.

The injuries by this species in Buffalo have been so general as to excite considerable attention from the public and have led to the issuing of a special circular by the board of public works, giving directions for controlling the insect. It was also reported as very abundant at Flushing, L. I.

Ravages by tent caterpillars. In early spring a number of reports came to me of the extraordinary abundance and destructiveness of the apple-tree tent caterpillar, *Clisiocampa americana* Fabr. In many localities the larvae stripped the trees and nearly covered the naked limbs with their webs. Such work was clearly the result of neglect and yet Mr S. D. Willard, of Geneva, who cares for his trees each year, informed me that this insect caused him considerable trouble last spring, notwithstanding his efforts to keep it under control.

Last year the so-called forest tent caterpillar, *Clisiocampa disstria* Hübn., was very injurious in certain parts of the state, stripping the foliage from hundreds of acres of maples and other trees in Delaware county and in other portions of the state. It was hoped that the ravages by this species would not be repeated the present season, but such was not the case. Examples of this caterpillar were received from Glens Falls, N. Y., on June 2, with the statement that they were very numerous and injuring the maples seriously. At Trenton Falls, N. Y., the caterpillars were very abundant, and injurious in the woods, though the trees were only partially defoliated. At Russell, St Lawrence county, the leaves were stripped from 125 acres of maple-trees, most probably by this species. It was also reported to me as very injurious this year in Otsego, Delaware and Greene counties.

Mamestra picta *Harris*. A remarkable abundance of larvae in timothy hay was brought to my notice on July 13. Mr W. C. Browning, of Alexandria Bay, states that he had been putting in hay from a 20-acre lot and the next morning found the surface of the mow literally alive with caterpillars, identified from examples sent as those of this species. Large numbers must have been present in the field, as they had probably been gathered up with the hay accidentally. In response to an inquiry, Mr Browning informed me that the caterpillars had not been observed except on this field. Last year they had entirely destroyed his crop of oats, and this season they were much more numerous than before.

Xylina antennatta *Walker*.^a One of the most interesting and remarkable outbreaks of the year occurred at Schenectady, N. Y., when hundreds of silver maples were defoliated by the caterpillars belonging to the species named above. My attention was called to the insect by a young man bringing me about $\frac{1}{2}$ pint of larvae with a story of their destructiveness. On visiting the city, it was found that the reports were true. The soft maples were practically stripped. Numerous larvae were seen on the trunks, in some cases 50 to 100 on a single tree. Many were seen along the walks and in the roadways bordered by the maples. Even were one deprived of sight, the olfactory organs could easily detect their presence from the peculiar odor emanating from the hosts of caterpillars. There were no indications of the insects' work in Albany, though only 17 miles distant, but along the Mohawk river as far west as Herkimer, on the Raquette river in St Lawrence county and in Schoharie county many soft maples were defoliated, indicating the work of the same insect, possibly, though the species could not be determined because no examples were submitted. The

^a Determined by Drs H. G. Dyar and J. B. Smith.

ravages in some of these localities may have been caused by the forest tent caterpillar, *Clisiocampa disstria* Hübn.

I have found no record of serious injury to maples by this species, though Dr H. G. Dyar, in a recent letter identifying the insect, informs me that it is somewhat injurious to soft maples at Bellport, Long Island, but that they were less common than usual the present season. This insect, or closely allied species, has been known for a number of years as injurious to apples and pears, and in 1896 and 1897 it caused considerable damage in this state to these fruits, but this appears to be the first record of serious injury to soft maples by a species of *Xylina*.

An elm-leaf miner. This insect has been unusually destructive in Albany and Troy the present season. For the past three years the Camperdown elms in Washington park, Albany, have suffered rather severely from this species. The present season the miner not only seriously injured the Camperdown elms but extended its ravages to the

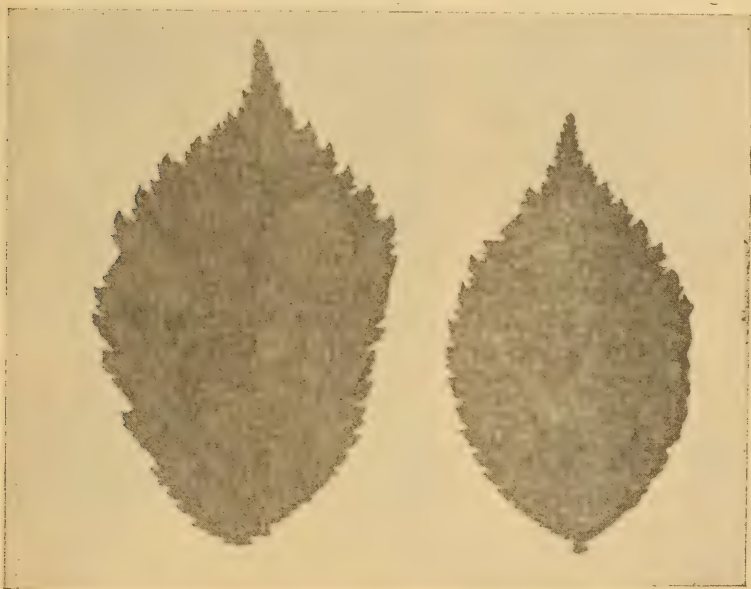


Fig. 17 Work of the elm-leaf miner (original).

English, Scotch and American species. From half to two-thirds of the leaves on certain English elms in Troy were nearly destroyed by this insect (fig. 17), and many others presented a sorry appearance on account of the numerous mines.

Chermes strobilobius Kalt.^a The form of this species^b which occurs on the larch has been under observation for the last three years in Washington park, Albany. On May 3 the larches were alive with females and eggs. Large masses of eggs were to be found at the base of nearly every fascicle of leaves on some limbs. Over 200 were counted in an egg mass of moderate size, while around the base of other fascicles two to three times this number were to be found. At this time the young were beginning to hatch and some had settled on the larch needles, where they presented a close resemblance to black grains of gunpowder. In the course of a few weeks, these young increase in size and excrete an abundant white woolly matter. They were so thick on the trees in 1897, that the latter part of June the larches appeared as though dusted with flour or starch.

The life history of this species, as worked out by European investigators, is most interesting, comprising, as it does, a life cycle of two years' duration, and passing through five generations. Briefly, it is as follows: 1) Wingless female lice pass the winter at the base of young pine buds, produce galls in the spring and in them winged 2) females develop, part of which migrate in August to the larches and lay eggs upon the needles. From these eggs emerge 3) young which hibernate in the crevices of the bark and the following spring attack the base of the buds and produce the eggs which attract attention on the larches, and from which the black 4) young emerge, a portion eventually developing into winged females, and returning to the pines the latter part of May (probably later in this latitude, as this generation is abundant upon larches till the last of June), where they lay eggs producing 5) males and females, which in turn are parents to the hibernating form first mentioned and thus the life cycle is completed.

So far as known, this is the first record of the occurrence of this species in America. The following synonyms are those given by Dr Cholodkovsky^c: *Chermes coccineus* Ratz.? in part; *C. laricis* Ratz., Koch in part; *C. geniculatus* Ratz., in part; *C. hamadryas* Koch; *C. atratus* Buckton?; *C. lariceti* Altum?

Pemphigus tessellatus Fitch.^d This insect, the alder blight aphid, has been abundant the past two years on a cut leaved alder in Washington park, Albany, and eventually injured it so much that the tree was removed. It occurs in masses on the under side of the twigs, sometimes being so numerous as to be 'hanging in strings' from the limbs. The

^a Added subsequently.

^b Identified by Dr N. Cholodkovsky, of St Petersburg, Russia.

^c Beiträge zu einer Monographie der Coniferen-Läuse. 1 Theil, Kapitel 5-7, 1896. p. 46.

^d Added subsequently.

abundant secretion of waxy threads renders it very prominent. The photograph of the adult colony represented in fig. 18*a* was taken July 1. About this time the young (fig. 19) appear in large numbers and found colonies near the tips of the smaller branches. Fig. 18*b*, of a young colony, is from a photograph taken July 16. This insect occurs not only on species of alder but also attacks birch. It has an enemy in the little orange butterfly, *Feniseca tarquinius* Fabr., the larva of which lives in the colonies and devours the aphids.



Fig. 18 Adult females and young of PEMPHIGUS TESSELLATUS (original).

Pulvinaria innumerabilis Rathv. This destructive scale insect is being constantly brought to notice here and there in the state, though during the past few years it appears to have been less destructive than usual. On July 5 this scale was reported as injuring the elms seriously at Sandy Hill, N. Y., and affecting the maples to a less extent. At that time the young had not left the protecting filaments of the mother, though they were numerous in the cottony secretion. A few days later twigs of maple were received from Baldwin, L. I., their con-

dition revealing a very serious attack. One side of each twig was nearly covered by the adults while the young fairly swarmed over everything (fig. 20). I have also received twigs badly infested with this scale from Batavia, Patchogue and Flushing, N. Y., and Arlington, N. J.



Fig. 19 Young of PEMPHIGUS TESSELLATUS (original).

Lecanium armeniacum *Craw.* One of the interesting features of the year was the detection of this scale, identified by Mr Pergande, in Erie county, N. Y. In response to inquiry about its introduction, Mr Hayes stated that he could not account for it in any manner. The vine upon which the species was found had been planted 10 years. His neighbors had not set out any Californian stock and he had used no fruit from that state for several years. A possible source of introduction is the sending to this state in 1896 of examples of this scale infested with *Comys fusca*, by Mr Ed. M. Ehrhorn, Horticultural commissioner of Santa Clara county, California. This was done, it was stated, in the hope that the parasite would attack the New York plum scale.

Lecanium cerasifex *Fitch.* This scale, identified as probably this species by Mr Coquillett, has been very injurious to several soft maples in Albany the past two or three years. The trees have been dwarfed by the attack and each summer are more or less blackened by the copious honey dew secreted by the insects. Many of the limbs were nearly covered with the scales on their under surface and during a portion, at least, of July and early in August the young swarmed over branches and leaves.

San José scale. This pest, *Aspidiotus perniciosus* Comst., has demonstrated its ability to thrive in the Hudson river valley as far north as Albany, at least. Just across the river at East Greenbush, an infested

fruit garden has been under my eye for over a year. The scale has spread in spite of the efforts of the owner, who used whale oil soap to some extent. It has ruined many currant bushes, and badly stunted a number of pear trees, besides infesting to a certain degree peach and apple-trees. On the 9th of last July, numerous young were to be found on the more tender shoots, some appearing as though dusted with pollen on account of



Fig. 20 Young of *PULVINARIA INNUMERABILIS* on maple leaf (original).

the larvae clustered at their tips. Developing scales were found in small numbers on the leaves and abundantly on the fruit. At its present rate of multiplication, most of the young trees in that garden will be ruined in a few years. Only this spring, I found the scale at Lebanon Springs, some 20 miles from the Hudson river, and at an elevation of 900 feet — 29° below zero being known in that locality. Even when exposed to such extremes of temperature, and probably outside the limits of the upper austral life zone, the insect had been able to not only hold its own but had increased some, as the few trees infested were badly covered with the scale. It had spread very little, though the trees had been set out

since 1895. This is evidently near the limit where climatic conditions are too severe to permit of its becoming a very injurious pest. The known distribution of this scale in the state is very interesting, since it has been found in localities here and there throughout most of the area lying within the limits of the upper austral life zone. It has been reported from localities in every county in the state east of the Hudson river, except Westchester and Washington and from those on its west bank south of Warren county, except Greene and Rockland. The following are the localities: Rensselaer county, East Greenbush; Columbia county, Lebanon Springs, Kinderhook and Germantown; Dutchess county, Poughkeepsie; Putnam county, Brewster; New York county, New York; Saratoga county, Burnt Hills; Albany county, Loudonville; Ulster county, Boiceville; Orange county, Middletown. Besides localities on Long Island, it has been found in Tompkins county at Ithaca; in Seneca county at Farmer and in Cayuga county at Union Springs.

LIST OF PUBLICATIONS OF THE ENTOMOLOGIST

The following is a list of the principal publications of the entomologist during the year 1898, 73^a are named, giving title, place and time of publication and a summary of the contents of each.

Corn-root worms. (Country gentleman. Feb. 10, 1898. 63: 107, col. 1, 2—16 cm)

From reading an account of the life history and habits of *Diabrotica longicornis* Say, a correspondent is led to inquire as to the identity of an insect which operated destructively on corn at Colora, Md., in 1895. In reply it is stated that the author of the attack is most probably the southern corn-root worm, *Diabrotica 12-punctata* Oliv., and preventive measures are given.

Kerosene emulsion. (Country gentleman. Feb. 17, 1898. 63: 126, col. 4—10 cm)

Directions are given for the preparation of the standard kerosene emulsion, and its proper dilution for use against several insects indicated. Continual experimenting to find the best strength for different insects and plants is recommended, and the method of application given.

Scurfy bark louse. (Country gentleman. Feb. 17, 1898. 63: 127, col. 1—10 cm)

A small piece of apple-tree bark from a correspondent in Babylon, N. Y., was found to be infested with *Chionaspis furfurus* Fitch. The scale is briefly described and the application in June of kerosene emulsion or whale oil soap solution recommended for its destruction.

A very different bug. (Country gentleman. Mar. 3, 1898. 63: 166, 167, col. 4, 1—11 cm)

A correspondent in Wyncote, Pa., sends an example of the two-spotted lady-bird, *Adalia bipunctata* Linn., and inquires if it is the Buffalo carpet beetle. The chief characters of this *Adalia* and of the Coccinellidae in general are given, and their beneficial habits mentioned. The carpet beetle, *Anthrenus scrophulariae* Fabr., is briefly described.

Two bad insects. (Country gentleman. Mar. 17, 1898. 63: 206, col. 3, 4—19 cm)

Apple twigs infested with the apple-tree bark louse, *Mytilaspis pomorum* Bouché, and others with the San José scale, *Aspidiotus perniciosus* Comst., were received from Brewster, N. Y. The climate of this state is congenial to the latter scale, as is shown by its large numbers at East Greenbush, N. Y., and its known distribution in the state is given. Badly infested trees should be burned—reference is made to the directions for using kerosene and remedies given for the apple-tree bark louse.

^a This includes also Dr Lintner's 12th report, which was issued the present year.

Codling moth. (Country gentleman. Mar. 24, 1898. 63: 226, col. 1, 2—14 cm)

A correspondent from Beaver Creek, Col., communicates a larva of the codling moth, *Carpocapsa pomonella* Linn., and inquires if it is the insect causing patches of dead bark on his apple-trees. It is stated that this species is not a wood borer and farther search for the cause of the trouble is recommended.

Bees injuring grapes. (Country gentleman. Mar. 24, 1898. 63: 226, col. 2, 3—14 cm)

Complaint is made from Dutchess county that bees injure sound fruit and inquiry is made of their habits in this respect. In reply, it is stated, that there is no reliable evidence of bees attacking uninjured fruit, but that species of *Vespa*, 'yellow jackets,' are known not only to attack sound fruit but even kill honey-bees. The exposure of a mixture of honey and sugar or glucose is advised as a palliative of the evil.

Not San José. (Country gentleman. Mar. 24, 1898. 63: 226, col. 3—5 cm)

Limbs of an apple-tree from Ulster co., believed to be infested with the San José scale, show no traces of that insect, only a few examples of the woolly aphid of the apple, *Schizoneura lanigera* Hausm., being found on the twigs.

Aphids in greenhouse. (Country gentleman. Mar. 31, 1898. 63: 247, col. 1—8 cm)

In response to a brief inquiry of how to rid a house of the green-fly, the method of smoking for aphids with moistened tobacco stems is described. Pyrethrum, hellebore, kerosene emulsion or a whale oil soap solution is also recommended.

Eel worms in clover. (Country gentleman. Ap. 7, 1898. 63: 266, col. 1, 2—33 cm)

Dead clover roots, received from Seal, Pa., showing a spongy texture and with the interstices filled with a pale brownish powder, have most probably suffered from the attack of eel-worms. Their general characteristics and life history are given, and the work in England of *Tylenchus devastatrix* Kuhn. is briefly described.

[The elm-leaf beetle] (Troy daily times. Ap. 7, 1898.—13 cm)

Responding to an inquiry, it is stated that the ravages of the elm-leaf beetle in Troy will probably be greater the coming season than last year. Spraying the trees with arsenites and destroying the larvae and pupae on the trunks and about the infested trees are recommended.

It is San José. (Country gentleman. Ap. 14, 1898. 63: 286, col. 3—5 cm)

Scales abounding on pieces of Japan plum bark received from Woodstown, N. J., are identified as the San José scale, *Aspidiotus perniciosus* Comst. Destroying the infested tree and watching others in the vicinity is recommended.

Probably not efficient. (Country gentleman. Ap. 14, 1898. 63: 286, 287, col. 4, 1—14 cm)

In response to an inquiry from a Long Island correspondent, the manner of preparing and using the lime, sulfur and salt wash for the San José scale is given, though it has little or no value in the eastern states.

Bag or basket worm. (Country gentleman. Ap. 21, 1898. 63: 307, col. 1, 2—17 cm)

Examples of the larval cases of this insect, *Thyridopteryx ephemeraeformis* Haworth, were received from New-Dorp, N. Y., with an inquiry as to their nature. The insect is briefly described and its life history given. Hand picking and spraying with paris green are the remedies recommended.

*Twelfth report on the injurious and other insects of the state of New York, for the year 1896. Albany. University of the State of New York. 1897. [Issued Ap. 22, 1898] 242p. 15pl. (In 50th report on the New York state museum, for the year 1896. Albany. University of the State of New York. 1898) [Issued June, 1898]

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[The city's shade trees] (Troy daily times. Ap. 25, 1898—18 cm)

The ravages of the elm-leaf beetle, *Galerucella luteola* Müller, in Troy are referred to and the necessity of prompt action in order to save the elms emphasized. The appearance of the beetles in the early spring and the method of spraying is described. Action by the civic authorities is about the only method affording adequate protection to the trees.

[Elm-tree beetle] (Argus [Albany] May 15, 1898. p. 7, col. 2—20 cm)

Popular misapprehension concerning the value of cotton bands around the trunks of elms as a preventive of injury by the elm-leaf beetle, *Galerucella luteola* Müller, is corrected. Spraying with arsenites is recommended, or, if that can not be done, the destruction of larvae and pupae around the base of the trees is a check upon the insect.

The punctured clover-leaf weevil. (Country gentleman. May 26, 1898. 63: 406, col. 3, 4—31 cm)

Greenish larvae with a white dorsal stripe injuring clover in Monroe county are identified as those of *Phytonomus punctatus* Fabr. Its earlier record, distribution and life history are given briefly. A fungus disease, *Empusa sphaerosperma*, is frequently very destructive to the larvae of this insect. Plowing infested fields is about the only satisfactory remedy for this pest.

Codling moth. (Country gentleman. May 26, 1898. 63: 406, col. 4—9 cm)

In response to an inquiry from Ilion, N. Y., brief directions are given for spraying to prevent the ravages of *Carpocapsa pomonella* Linn.

To destroy ant hill. (Country gentleman. June 9, 1898. 63: 446, col. 2—8 cm)

Method of treating ant hills with carbon bisulfid is briefly detailed.

Forest tent caterpillar. (Country gentleman. June 9, 1898. 63: 450, col. 4—5 cm)

Short notice of the ravages of *Clisiocampa dissidia* Hübn. last year and reference to its abundance this season.

Certain destructive scale insects. (Country gentleman. June 9, 1898. 63: 453, 454, col. 3, 4, 1—70 cm)

Gives a few general remarks on scale insects and their detection, which is followed by the life histories and remedies in brief for the apple-tree bark louse, *Mytilaspis pomorum* Bouché, and the scurfy bark louse, *Chionaspis furfurus* Fitch. The resistance of the San José scale, *Aspidiotus perniciosus* Comst., to the severe climate 20 miles back from the Hudson is commented upon. The characteristics, life history and remedies for this scale are briefly given.

Apple-tree bark louse. (Country gentleman. June 9, 1898. 63: 454, col. 1, 2 — 15 cm)

Mytilaspis pomorum Bouché and *Dolerus sericeus* Say are identified. Some observations are given on insect legislation, and the scope of a practical law indicated.

Cut worms. (Country gentleman. June 16, 1898. 63:470, col. 2, 3 — 14 cm)

In response to an inquiry from Columbia county requesting remedies for cut worms injuring cauliflower and cucumbers, digging them out or the use of poisoned baits of several kinds is recommended.

Black ants. (Country gentleman. June 16, 1898. 63:470, col. 3 — 5 cm)

A complaint from Broome county states several means found of no avail against black ants. Reference is given to directions in the preceding number of the *Country gentleman* for treating the nests with carbon bisulfid.

Cherry-leaf beetle. (Country gentleman. June 16, 1898. 63:471, col. 3 — 5 cm)

Records an attack by *Galerucella cavicollis* LeC. on cherry-trees in Steuben county.

Brown apricot scale. (Country gentleman. June 16; 1898. 63:474, col. 1, 2 — 23 cm)

Scales on a grapevine from Erie county, N. Y., are identified as *Lecanium armenicum* Craw, and briefly described. It is stated that possibly in attempting to transport its parasite, *Comys fusca*, the scale was also brought into the state. It would be well to stamp the insect out at once if possible. The remedies given are treatment with kerosene emulsion or a whale oil soap solution. Farther information respecting its introduction is requested.

[See page 239 of this report]

[Destructive maple caterpillar] (Schenectady daily union. June 20, 1898. p. 2 — 37 cm)

Gives briefly the injuries to silver maples in Schenectady, N. Y., by a caterpillar which is probably *Nadata gibbosa* [since identified as *Xylina antennata* Walker]. Its life history is briefly summarized and a second brood stated to be a possibility. It is unlikely that it will be injurious another season, but it is advisable to destroy all the larvae possible around the trees with hot water or kerosene emulsion. A caution is given about cutting back the defoliated trees.

[See pages 207-13, 235, 236 of this report]

Address delivered before the Dana natural history society, at the field meeting held at Trenton Falls, N. Y., June 17, 1898. (Albany evening journal. June 21, 1898. p. 8, col. 4, 5 — 46 cm)

The incentives to entomological study, as shown by the large number of insects and the many unknown forms, are briefly given. The necessity of an army of observers is indicated by the magnitude of the field. The method of studying the life history of insects is described and its advantages mentioned. After the introduction, observations during the trip were given — the following being briefly mentioned: spittle insects, *Xylina antennata*, tent caterpillars, *Crambus agitatellus*, predaceous and parasitic insects, etc.

Insects on honeysuckle. (Country gentleman. June 23, 1898. 63:490, col. 1 — 4 cm)

Records the beneficial work of *Adalia bipunctata* in reducing the numbers of plant lice on honeysuckle.

Pests—Virginia creeper. (Country gentleman. June 23, 1898. 63: 490, col. 2—9 cm)

Apple-tree aphid, *Aphis mali* Fabr., is identified, the remedy given and the statement made that the species will probably not cause farther injury the present season. The plum curculio is identified by its work. The Virginia creeper is thought to be of but little injury to old trees.

Maples defoliated. (Country gentleman. June 23, 1898. 63: 491, col. 3—8 cm)

Hundreds of silver maples were defoliated by a species of *Nadata* [*Xylina antennata* Walker] in Schenectady. The outbreak is probably due to a dearth of parasites or favorable climatic conditions, and illustrates the destructive powers of many insects if unchecked.

[See pages 207—13, 235, 236 of this report]

Elm-leaf beetle. (Country gentleman. June 30, 1898. 63: 513, col. 3, 4—49 cm)

A brief general account of *Galerucella luteola* Müller, giving ravages in Albany and Troy, its description, life history, habits and best methods of controlling the pest.

Harlequin cabbage bug. (Country gentleman. June 30, 1898. 63: 514, col. 1, 2—33 cm)

This insect, *Murgantia histrionica* Hahn., received from Mason county, W. Va., is figured, described, its distribution given and the additional territory it may be expected to invade indicated. The destructiveness of the insect is mentioned, and the use of rows of radishes or mustard as lures, where the bugs may be destroyed, is recommended. Its two egg parasites, *Trissolcus murgantiae* and *T. podisi* are mentioned.

Gall on white oak. (Country gentleman. June 30, 1898. 63: 514, col. 2 — 18 cm)

Galls on white oak, from Columbia county, N. Y., are identified as those of *Andricus seminator* Harris and briefly described. The general characters of galls produced by insects are given and some interesting facts noted about the *Cynipidae* or gall flies.

Pear-leaf blister-mite. (Country gentleman. July 7, 1898. 63: 526, 527, col. 4, 1 — 14 cm)

The work of *Phytoptus pyri* Scheuten is identified, described, and the importance of fumigating nursery stock in order to prevent the distribution of such pests emphasized. Destroying the infested leaves or spraying in winter with kerosene emulsion diluted with five to seven parts of water is recommended.

Fleas and how to kill them. (Country gentleman. July 7, 1898. 63: 537, col. 2 — 17 cm)

Though the cat and dog flea, *Ceratopsyllus serraticeps*, is usually termed the flea, there are 47 species known to occur on animals. The life history of the dog flea is briefly given. Benzine, pyrethrum, sticky fly paper and cleanliness are the means recommended for controlling these pests.

[*Xylina* not *Nadata*] (Schenectady daily union. July 8, 1898. p. 5, col. 4 — 9 cm)

Corrects the first reference to *Nadata* of the caterpillars devastating the maples and states that they are either *Xylina laticinerea* or *X. antennata*. There is but one brood in a season. Spraying with paris green in the early spring is recommended.

[See pages 207-13 of this report]

Cucumber beetle — cabbage worms. (Country gentleman. July 14, 1898. 63: 546, col. 2 — 21 cm)

Gives briefly the habits and life history of the striped cucumber beetle, *Diabrotica vittata* Fabr., and recommends protecting the young plants with netting. Planting of beans between the cucumbers, dusting the vines with land plaster, ashes or even road dust are preventives of serious injury. Clean culture is advised. If the roots are badly infested with the grubs, carbon bisulfid is the best remedy.

Fresh hellebore, one ounce to three gallons of water, is recommended for the cabbage worm, *Pieris rapae*. Paris green may be used if the cabbages have not headed.

Destructive rose bug. (Country gentleman. July 14, 1898. 63: 546, col. 3 — 20 cm)

This insect, *Macrodactylus subspinosus* Fabr., is identified and its injuries in New England and New Jersey mentioned. Its life history is briefly given. Paris green or kerosene emulsion is usually not very satisfactory, owing to the beetle's resistance to insecticides. Collecting the insects by some mechanical contrivance or protecting plants by netting are the most satisfactory means of preventing serious injury.

Hessian fly in Pennsylvania. (Country gentleman. July 14, 1898. 63: 546, 547, col. 4, 1 — 38 cm)

In response to an inquiry from Adams county, Pa., where this insect, *Cecidomyia destructor* Say, has been very injurious, a general account of the species is given as follows: Immense losses caused by it in New York and Ohio. Its life history. Characteristics of an attack. Its parasites and their value. Its abundance another season can not be forecast, as it may be injurious for a series of years. As preventives of injury, late planting supplemented by the early sowing of narrow strips to act as decoys, the burning of stubble and chaff, clean culture, rotation of crops and the growing of resistant varieties of wheat, so far as possible, are recommended.

Work of *Xylina*. (Country gentleman. July 14, 1898. 63: 551, col. 2 — 6 cm)

Corrects the reference of this insect on page 491 of the current volume of the *Country gentleman*, from *Nadata* to *Xylina* — it being either *X. laticinerea* or *X. antennata*. Its identity with the species seriously injuring apples last year is thus rendered probable. A note is given of the defoliated soft maples along the Mohawk river, presumably by this species.

[See pages 207-13 of this report]

Forest tent caterpillar. (Country gentleman. July 14, 1898. 63: 551, col. 2, 3 — 11 cm)

Records serious injuries the present season by *Clisiocampa disstria* Hübn. in St Lawrence, Oneida, Otsego, Delaware and Greene counties. As the cost of spraying

or collecting the eggs would be too great in woods, it is advisable to burn over the ground soon after the insects have pupated, provided there is not so much fuel on the surface as to produce a fire injurious to the trees.

[See pages 191-201 of this report]

[Periodical Cicada] (Argus [Albany]. July 15, 1898. p. 4, col. 6—10 cm)

A brief review of Bulletin 14, U. S. Dep't agriculture, Division of entomology, commending a few of the many excellent features of this work.

Elm-leaf beetle in New York state. (Bulletin New York state museum. v. 5, no. 20, 1898 [Issued July 15]. 43 p. 6 pl.

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Forest tent caterpillar. (Country gentleman. July 21, 1898. 63:567, col. 2—6 cm)

Caterpillars from Exeter, N. Y. are identified as those of *Clisiocampa disstria* Hübn., and reference is given to an earlier notice of the insect.

Work of the oak pruner. (Country gentleman. July 21, 1898. 63:573, col. 4—16 cm)

Larvae boring in oak from Ulster county, N. Y., are those of *Elaphidion villosum* Fabr. Notes on their habits, injuries along Lake George and transformations are given. Collecting and burning the fallen twigs is recommended.

Molting of a tarantula. (Argus [Albany]. July 23, 1898. p.3—15 cm; also in Country gentleman. Aug. 4, 1898. 63:616, col. 3—16 cm; Worcester [Mass.] telegram. Aug. 14, 1898)

States why molting is necessary for spiders and insects and describes briefly the process in this instance. This female spider, *Eurypelma hentzi* Girard, was under the care of Dr J. M. Bigelow for two years. Its previous molt was about the latter part of 1896.

[See pages 219, 220 of this report]

Zebra caterpillar. (Country gentleman. July 28, 1898. 63:586, col. 2, 3 — 26 cm)

Caterpillars swarming on recently gathered timothy hay from a 20-acre lot at Alexandria Bay, N. Y., are identified as those of *Mamestra picta* Harris. The larva is briefly described, figured and the life history of the insect given. As oats on the field were destroyed the previous year by caterpillars, the larvae were probably abundant in the field this year and were accidentally gathered up with the hay. The destruction of those in the barn is recommended.

[See pages 201-7 of this report]

[Suggestions in regard to nursery inspection] (Country gentleman. July 28, 1898. 63:586, col. 3 — 12 cm)

In compliance with a request from the commissioner of agriculture, it was recommended that nursery stock infested with San José scale, *Aspidiotus perniciosus* Comst. and closely allied forms, the black peach aphid, *Aphis prunicola* Kalt., or badly infested with the more common destructive scale insects be destroyed or adequately treated. Those slightly infested with scale insects, badly infested with the pear psylla or aphids, or bearing cocoons of *Bucculatrix pomifoliella* Clem. should be fumigated before shipment. Plants showing injury from insects should not be pronounced clean till the cause has been ascertained.

[A plea for the elms] (Troy daily times. July 29, 1898 — 17 cm)

Excessive ravages of the elm-leaf beetle, *Galerucella luteola* Müller, are described and a plea made for the proper protection of the elms. If no action is taken, it is stated that most of the European and many American elms in the city will be ruined within three years.

[Remedies for the white-marked tussock moth] (Buffalo news. July 30, 1898. 36:5 — 22 cm; also in Commercial, times and inquirer [Buffalo]. July 30, 1898. 55:5; Buffalo commercial. July 30, 1898. p. 11; and part in Buffalo daily times. July 30, 1898. 39:5)

Gives objections to spraying with paris green, recommends collecting the egg clusters, and states the advantages of delaying the work till winter or early spring. Several methods of collection are briefly considered.

[Brown patches on the lawn] (American gardening. July 30, 1898. 19:549, col. 1 — 8 cm)

Brown patches on a lawn are identified as most probably the work of white grubs and directions for spraying with kerosene emulsion given.

Asparagus beetle in Albany county. (Country gentleman. Aug. 4, 1898. 63:614, col. 2 — 18 cm)

Notes the occurrence of the beetle at Menands. The insect is figured and briefly described in its different stages. Land plaster or paris green is given as the best remedy.

Sulfur not a remedy. (Clinton [Mass.] courant. Aug. 6, 1898. 50:5, col. 3 — 6 cm)

Replying to an earlier notice, it is stated that plugging trees with sulfur is not a remedy for caterpillars.

Maple-tree scale. (Country gentleman. Aug. 11, 1898. 63:630, 631, col. 4, 1 — 13 cm)

This scale insect, *Pulvinaria innumerabilis* Rathv., is briefly described and the localities mentioned where it has been reported as abundant. Its prolificacy and destructiveness are noticed and spraying with kerosene emulsion or a whale oil soap solution recommended.

A butterfly caterpillar. (Country gentleman. Aug. 11, 1898. 63:633, col. 4 — 13 cm)

The larva of *Jasoniades glaucus* Linn. is identified, briefly characterized and its means of protection by a peculiar scent organ described. The markings of the parent and its transformations are briefly given.

A walking stick. (Country gentleman. Aug. 18, 1898. 63:647, col. 1 — 12 cm)

A strange insect from Amboy, N. Y., is identified as the walking stick, *Diapheromera femorata* Say. It is briefly described, its injuries to forests in 1877 alluded to and its life history given.

Apple-tree tent caterpillar. (Country gentleman. Aug. 18, 1898. 63:653, col. 3 — 33 cm)

In an inquiry from Duluth, Minn., the writer describes the extensive ravages of a pest and gives its habits. The insect is identified from a nest as *Clisiocampa americana* Fabr. Its life history is given and collecting egg belts, destroying the young in their nests, or spraying with poisons recommended. Encouraging the native birds is stated to be very profitable on account of securing their aid in controlling insect pests.

[Save the elm trees] (Troy budget. Aug. 21, 1898. p. 12, col. 4, 5 — 82 cm)

The ravages of the elm-leaf beetle in Troy and adjacent places are described in detail and spraying recommended. The remainder is largely a reprint of portions of *Museum bulletin* 20 on this insect.

About the hellgramite. (Country gentleman. Aug. 25, 1898. 63:673, col. 4 — 31 cm)

In response to an inquiry about its transformations, this large neuropterous insect, *Corydalis cornuta* Linn., is figured, briefly described and its life history given. The difference between this insect and a butterfly is pointed out.

[Whale oil soap and fumigation] (State of New York, Dep't agriculture. Formulas, 1898. [Issued Aug. 26] p. 5-7 — 27 cm)

Gives formula and direction for using the whale oil soap solution, also the method of fumigating nursery stock and the proportions of chemicals found most effective.

[Abstract of a paper read before the Association of economic entomologists, at Boston, Mass., Aug. 19] (Country gentleman. Sep. 1, 1898. 63:690, col. 3, 4 — 14 cm)

Gives a brief abstract of 'Notes on the insects of the year in the state of New York.'

[See pages 230-41 of this report]

Asparagus beetles. (Country gentleman. Sep. 1, 1898. 63:693, col. 3, 4 — 19 cm)

Records the occurrence of *Crioceris 12-punctata* Linn. in the vicinity of Buffalo, N. Y., and its present distribution is outlined. The distribution along the Hudson river valley of *Crioceris asparagi* Linn., as ascertained by Dr L. O. Howard, is given and its presence at Maynard, Oneida county, noted.

Killing insects through plant roots. (Country gentleman. Sep. 1, 1898. 63:694, col. 1 — 17 cm)

In response to an inquiry in regard to the possibility of controlling insects through the roots of plants, it is stated that owing to the selective action of the roots and other causes success could not be expected, though it would do no harm to experiment provided extreme caution was exercised in drawing conclusions.

Plague of flies. (Country gentleman. Sep. 8, 1898. 63:712, col. 2, 3 — 17 cm)

In response to an inquiry from Cortland county, it is stated that the abundance of flies in any locality is proportionate to the number and extent of favorable breeding places in the vicinity. Keeping manure where flies can not obtain ready access to it and the use of chlorid of lime, darkening of stables and the application to the stock of fish oil and tar, or axle grease, are measures recommended.

Notes on the Boston meeting. (Country gentleman. Sep. 8, 1898. 63:713, 714, col. 4, 1 — 44 cm)

In response to a request, some brief notes are given on the meeting of the Association of economic entomologists, held at Boston, August 19-20. After mentioning the value of meeting fellow workers from all parts of the country, certain differences in the behavior of insects and insecticides in several states are noticed. The magnificent work of the Massachusetts state board of agriculture against the gypsy moth, *Porthetria dispar* Linn., and the brown-tailed moth, *Euproctis chrysorrhoea* Linn., is noticed at some length and several of the improved devices and methods described. The importance to the country at large of this attempt to exterminate these insects is discussed and mention made of the hearty indorsement of the work by the visiting entomologists.

Insects on chrysanthemums. (American gardening. Sep. 10, 1898. 19:639, col. 1, 2 — 8 cm)

Identifies the tarnished plant bug, *Lygus pratensis* Linn., and the insidious flower bug, *Triphleps insidiosus* Say, and gives their habits and remedies.

A katydid. (Country gentleman. Sep. 15, 1898. 63:726, col. 3 — 12 cm)

Identifies eggs found on the belt of a sewing machine at Marietta, Ga., as probably those of *Microcentrum laurifolium* Linn. The method of oviposition is briefly described and several curious places where katydid eggs were found mentioned. The life history of this species is outlined.

[Insect for name] (American gardening. Sep. 17, 1898. 19:653, col. 2 — 10 cm)

The larva of the hag moth, *Phobetron pithecium* Sm.-Abb., is identified, briefly described and a résumé of its life history given.

[Ponds and mosquitoes] (Country gentleman. Oct. 6, 1898. 63:794, col. 1 — 20 cm)

In response to questions, it is stated that mosquitoes breed only in still water, and are more likely to be abundant where plants supply plenty of food. Remedies mentioned are: artificial agitation of the water, the introduction of fish to their breeding places and applying kerosene to the surface of the water.

Preventives of insect depredations. (Country gentleman. Oct. 13, 1898. 63:813, 814, col. 4, 1 — 28 cm)

A general article recommending the clearing up and burning rubbish in the gardens, going over the orchards for various insects, preparing for canker worms, and protecting and encouraging the native birds during the winter.

[Attacked by joint worms] (Country gentleman. Oct. 13, 1898. 63:814, col. 1 — 23 cm)

In response to an inquiry from Frederick county, Md., the depredator on wheat is identified from examples sent as probably *Isosoma grande* Riley. The characteristics of the attack, life history of the insect and its earlier ravages are given. Burning the stubble in infested fields and the screenings from the wheat is recommended.

CONTRIBUTIONS TO THE COLLECTION IN 1898

Hymenoptera

Honey bee, *Apis mellifica* Linn., 29 July. From Mrs **L. A. Millington**, New Russia, N. Y.

Sphex ichneumonea Linn., 9 Sep. From Mrs **E. B. Smith**, Coeymans, N. Y.

Tarantula killer, *Pepsis formosa* Say, female, 25 July. From Miss **E. S. Torrey**, San Diego, Cal.

The wheat joint worm, *Isosoma ? grande* Riley, 3 Oct. From **A. D. Thomas**, Frederick county, Md.

Gall, from which 235 adults were reared, of *Andricus seminator* Harris on oak, 25 June. From **R. R. Livingston**, Cheviot-on-Hudson, N. Y.

Lunate long-sting, *Thalessa lunator* Fabr., 14 Sep. From Prof. **C. H. Peck**, Menands, N. Y.

Pigeon tremex, *Tremex columba* Linn., 19 May. From **S. C. Bradt**, Albany, N. Y.

Dolerus sericeus Say on apple trees, 19 May. From **G. H. Brackenbury**, Auburn, N. Y.

Coleoptera

Six-spotted tiger beetle, *Cicindela sexguttata* Fabr., 16 Aug. From **M. F. Adams**, Buffalo, N. Y.

Fiery ground beetle, *Calosoma calidum* Fabr., 20 Aug. From **J. A. Otterson**, Berlin, Mass.

Pterostichus lucublandus Say, 4 July. From Mrs **E. B. Smith**, Coeymans, N. Y.

Harpalus pennsylvanicus DeGeer in coition, 19 Sep. From **E. T. Schoonmaker**, Cedar Hill, N. Y.

Carrion beetles, *Silpha americana* Linn., and *Silpha inaequalis* Fabr., 16 Aug. From **M. F. Adams**, Buffalo, N. Y.

Two-spotted lady-bird, *Adalia bipunctata* Linn., 16 May. From Miss **Mary R. Hyde**, Binghamton, N. Y.

Pale brown Byturus, *Byturus unicolor* Say, in raspberry buds, 23 May. From Prof. **C. H. Peck**, Menands, N. Y.

Numerous rose beetles, *Macrodactylus subspinosus* Fabr., injuring snow-ball, 27 June. From **T. H. L.**, Loudonville, N. Y.

Western ten-lined June bug, *Polyphylia decemlineata* Say, 12 Sep. From Miss **Margaret Torrey**, San Diego, Cal.

Spotted grapevine beetle, *Pelidnota punctata* Linn., 19 May. From **S. C. Bradt**, Albany, N. Y. Same, 16 Aug. From **M. F. Adams**, Buffalo, N. Y.

Green June beetles, *Allorhina nitida* Linn., 29 July. From **Chester Young**, Flushing, N. Y.

Indian cetonian, *Euphoria inda* Linn., 16 Aug. From **M. F. Adams**, Buffalo, N. Y.

Osmoderma scabra Beauv., 28 July. From Mrs **E. B. Smith**, Coeymans, N. Y.

Oak limbs burrowed by the oak pruner, *Elaphidion villosum* Fabr., 11 July. From **C. H. Roberts**, Oakes, Ulster county, N. Y. A larva of same, 2 July. From Mrs **James R. Gilmore**, Lake George, N. Y.

Maple borer, *Plagionotus speciosus* Say, 16 Aug. From **M. F. Adams**, Buffalo, N. Y.

Cloaked knotty horn, *Desmocerus palliatus* Forst., 16 Aug. From **M. F. Adams**, Buffalo, N. Y.

Round-headed apple-tree borer, *Saperda candida* Fabr., and the elm borer, *Saperda tridentata* Oliv., with infested wood and numerous larvae, 20 Aug. From **J. A. Otterson**, Berlin, Mass.

Red milkweed beetle, *Tetraopes tetraophthalmus* Forst., 16 Aug. From **M. F. Adams**, Buffalo, N. Y.

Numerous examples of the asparagus beetle, *Crioceris asparagi* Linn., 23 July. From Prof. **C. H. Peck**, Menands, N. Y. Same, 16 Aug. From **M. F. Adams**, Buffalo, N. Y. Same, 19 Sep. From **E. T. Schoonmaker**, Cedar Hill, N. Y.

12-spotted asparagus beetle, *Crioceris 12-punctata* Linn., 16 Aug. From **M. F. Adams**, Buffalo, N. Y.

Chrysochus auratus Fabr., 16 Aug. From **M. F. Adams**, Buffalo, N. Y.

Chrysomela multiguttata Stål. on elm, 31 May. From **J. W. Olmstead**, Northville, N. Y.

Cherry leaf beetle, *Galerucella cavicollis* LeC. on cherry-tree, 8 June. From **Thomas Tupper**, Corning, N. Y.

Golden tortoise beetle, *Coptocycla bicolor* Fabr. on morning glory, 16 July. From **J. G. Linsley**, Oswego, N. Y.

Chelymophra argus Licht. 16 Aug. From **M. F. Adams**, Buffalo, N. Y.

Beans infested with bean weevil, *Bruchus obtectus* Say, 17 Feb. From **M. Ames**, Glens Falls, N. Y.

The meal worm, *Tenebrio molitor* Linn., 4 July. From Mrs **E. B. Smith**, Coeymans, N. Y.

Fungus beetle *Boletotherus bifurcus* Fabr., 29 Sep., in fungus at Rome, N. Y. From **A. W. Wright**, Albany, N. Y.

Cryptorhynchus lapathi Linn., 16 Aug. Also mines of same, dated 5 June. From **M. F. Adams**, Buffalo, N. Y.

Number of larvae of the clover leaf weevil, *Phytonomus punctatus* Fabr., 10 May. From **J. Hannam Clark**, Moreton Farm, N. Y. Imago of same, 20 Aug. From **J. A. Otterson**, Berlin, Mass.

Diptera

House fly, *Musca domestica* Linn., infested with *Trombidium muscarum* Riley, some of which had transformed to the hypopus form, 29 July. The same with *Trombidium* and *Chernes*, 12 Oct. From **J. G. Linsley**, Oswego, N. Y.

Blow fly, *Lucilia caesar* Linn., 20 Aug. From **J. A. Otterson**, Berlin, Mass.

Examples of *Psilopus siphio* Say, 12 Aug. From Mrs **C. McDougall**, Plattsburg, N. Y.

Bee slayer, *Promachus ?fitchii* O. S., 29 July. From Mrs **L. A. Millington**, New Russia, N. Y.

Large black horse fly, *Tabanus atratus* Fabr., 19 May. From **S. C. Bradt**, Albany, N. Y.

Lepidoptera

Thecla species, near *T. calanus*, 6 July. From Prof. **C. H. Peck**, Menands, N. Y.

Cabbage butterfly, *Pieris rapae* Linn., 4 July. From Mrs **E. B. Smith**, Coeymans, N. Y.

Larva of the swallow tail butterfly, *Jasoniades glaucus* Linn., 1 Aug. From **S.**, Altamont, N. Y. Same, 9 Aug. From **F. B. Southwick**, Rockroyal, N. Y. Imago, 9 Sep. From Mrs **E. B. Smith**, Coeymans, N. Y.

Several larvae of *Epargyreus tityrus* Fabr. on honey locust, 29 Aug. Also others, 9 Sep. From Mrs **E. B. Smith**, Coeymans, N. Y.

Larvae of *Thyreus abbotii* Swain., 7 July. From **J. G. Linsley**, Oswego, N. Y.

Larva, dark variety, of *Deilephila lineata* Fabr. on sugar beet, 19 Sep. From **E. T. Schoonmaker**, Cedar Hill, N. Y.

A larva of *Alypia octomaculata* Fabr. on Virginia creeper, 16 July. From **W. H. Coleman**, Albany, N. Y.

Halisidota tessellaris Sm.-Abb., 20 Aug. From **J: A. Otterson**, Berlin, Mass.

Hickory tussock caterpillar, *Halisidota caryae* Harris on locust, 20 Aug. From Miss **R. Thompson**, Ballston Spa, N. Y. Same, 9 Sep. From Mrs **E. B. Smith**, Coeymans, N. Y.

Several larvae of the white-marked tussock moth, *Notolophus leucostigma* Sm.-Abb., on wisteria, 10 June. From **James Goold**, Albany, N. Y. Same, 29 June. From Mrs **W: M. Griffith**, Albany, N. Y. Larvae and pupae of same, 1 July. From Miss **J. J. Forqurean**, Albany, N. Y. Cocoons and egg clusters of same, on plum trees, 16 July. From **W. H. Coleman**, Albany, N. Y. Female, cocoons and egg masses of same, 29 July. From **Chester Young**, Woodside, N. Y.

Larvae of *Euclea indetermina* Boisd. on azalea, 25 Aug. From **O. F. Zollikoffer**, New Rochelle, N. Y.

Larva of the hag moth, *Phobetron pithecium* Sm.-Abb., 5 Sep. From **Leonard Barron**, New York. Same, 14 Sep., pupated the 16th. From **J. M. Dolphe**, Port Jarvis, N. Y.

Bag worm, *Thyridopteryx ephemeraeformis* Haw., on Crataegus, 9 Ap. From **T. L. Meinikheim**, New York.

Red-humped apple-tree caterpillar, *Oedemasia concinna* Sm.-Abb. on blackberry and rose bush, 20 Aug. From Miss **Alice Young**, Clinton, Mass. Same on plum, 10 Sep. From **J: A. Otterson**, Berlin, Mass.

Cecropia moth, *Samia cecropia* Linn., 4 June. From **W. C. Hitchcock**, Cropseyville, N. Y. Larva of same, 27 Aug. From **S. C. Bradt**, Albany, N. Y.

Male, female and eggs of the luna moth, *Tropaea luna* Linn., 12 May. From **W. E. Wetmore**, West Salamanca, N. Y.

Larva of the American silk worm, *Telea polyphemus* Linn., 23 Sep. From **J: A. Otterson**, Berlin, Mass.

Female io moth, *Automeris io* Fabr., 20 Aug. From **J: A. Otterson**, Berlin, Mass.

Egg belts of the apple-tree tent caterpillar, *Clisiocampa americana* Fabr. on peach, 29 July. From Geneva, N. Y., through State department of agriculture.

Forest tent caterpillar, *Clisiocampa dissτρια* Hübn., 2 June. From **C. L. Williams**, Glens Falls, N. Y. Cast skins of same, on maple leaves, 8 June. From Mrs **Elizabeth Benedict**, Glens Falls, N. Y. Larvae of same, 13 July. From **Moses Daly**, Exeter, Otsego co., N. Y.

Feltia jaculifera Guen., 9 Sep. From Mrs **E. B. Smith**, Coeymans, N. Y.

Three larvae of the zebra caterpillar, *Mamestra picta* Harris, 19 July. From **W: C. Browning**, Alexandria Bay, N. Y. Same on sugar beets, 19 Sep. and 8 Oct. From **E. T. Schoonmaker**, Cedar Hill, N. Y.

Examples of *Xylina antennata* Walker defoliating maples, 15 June. From Dr **M. G. Planck**, Schenectady, N. Y. Numerous larvae of same, from Schenectady, through state department of agriculture.

Catocala parta Guen., 4 July, *Catocala cara* Guen., 9 Sep. From Mrs **E. B. Smith**, Coeymans, N. Y.

Larva of *Cacoecia rosaceana* Harris on elm, 31 May. From **J. W. Olmstead**, Northville, N. Y.

Codling moth, *Carpocapsa pomonella* Linn., from under the bark of an apple tree, 7 Mar. From **D. Woodriff**, Beaver Creek, Col.

Mecoptera

Two females of a scorpion fly, *Panorpa maculosa* Hagen, sucking the fluids from wounded gypsy moth larvae, *Porthetria dispar* Linn., 1 July. From **A. H. Kirkland**, Malden, Mass.

Neuroptera

Dendroleon obsoletum Say, 20 Aug. From **J: A. Otterson**, Berlin, Mass.

Ant lion, ?*Myrmeleon* sp., from the Indian Ladder, New Scotland, 1 Aug. From Dr **F: J. H. Merrill**, Albany, N. Y.

Hemiptera

Spined soldier bug, *Podisus spinosus* Dallas, observed feeding on larvae of *Crioceris asparagi* and also one trying to insert its proboscis into a beetle, 20 Aug. From **J: A. Otterson**, Berlin, Mass.

Nymphs of *Cosmopepla carnifex* Fabr. on asparagus, 25 July. From Prof. **C: H. Peck**, Menands, N. Y.

Euschistus fissilis Uhler on asparagus, 20 Aug. From **J: A. Otterson**, Berlin, Mass. The same, 19 Sep. From **E. T. Schoonmaker**, Cedar Hill, N. Y.

Euschistus tristigmus Say, 4 Sep. From Mrs **E. B. Smith**, Coeymans, N. Y.

Nezara hilaris Say, adults and young feeding on asparagus, 20 Aug. From **J: A. Otterson**, Berlin, Mass.

Squash bug, *Anasa tristis* DeGeer, 19 Sep. From **E. T. Schoonmaker**, Cedar Hill, N. Y.

Calocoris rapidus Say on asparagus, 19 Sep. From **E. T. Schoonmaker**, Cedar Hill, N. Y.

Tarnished plant bug, *Lygus pratensis* Linn., on chrysanthemums, 30 Aug. From **Leonard Barron**, New York. Same on chrysanthemums, 20 Aug. From Mrs **C. McDougall**, Plattsburg, N. Y.

Insidious flower bug, *Triphleps insidiosus* Say, on chrysanthemums, 30 Aug. From **Leonard Barron**, New York.

Phymata wolffii Stål., 20 Aug. From Miss **Alice Young**, Clinton, Mass. The same, 20 Aug. From **J. A. Otterson**, Berlin, Mass.

Masked bed bug hunter, *Opsicoetus personatus* Linn., 20 Aug. From **J. A. Otterson**, Berlin, Mass.

Harvest fly, *Cicada tibicen* Linn., 9 Sep. From Mrs **E. B. Smith**, Coeymans, N. Y.

Cast skins of nymphs of ? *Ceresa bubalus* Fabr. on locust trees, 1 July. Miss **J. J. Forqurean**, Albany, N. Y.

Diedrocephala coccinea Forst., 28 Sep. from Ct. From **Leonard Barron**, New York.

Gypona angulata Spang., 20 Aug. From **J. A. Otterson**, Berlin, Mass.

Chermes abietis Linn. on black spruce at North Elba, N. Y., 2 July. From Prof. **C. H. Peck**, Menands, N. Y.

Woolly aphid of the apple, *Schizoneura lanigera* Hausm., on apple twigs, 17 Mar. From **M. H. Davis**, Boiceville, N. Y.

Numerous examples of a woolly plant louse, *Schizoneura rileyi* Thos., on elm, 31 May. From **J. W. Olmstead**, Northville, N. Y.

Apple aphid, *Aphis mali* Fabr., on apple at Norwich, Ct., 14 June. From **P. C. Lewis mfg. co.**, Catskill, N. Y.

Examples of the cottony maple-tree scale, *Pulvinaria innumerabilis* Rathv., on elm, 3 July. From **Marcus C. Allen**, Sandy Hill, N. Y. Same badly infesting soft maple, 9 July. From **John Woltz**, Baldwin, L. I. Same badly infesting twigs of sugar maple, 28 July. From Miss **Kate Fisher**, Batavia, N. Y. Same on soft maple, 29 July. From **Chester Young**, Flushing, N. Y. Same on maple, 5 Aug. From **A. H. Stratton**, Arlington, N. J. Young of same infesting silver maple leaves, 30 Aug. From Geneva, N. Y., through state department of agriculture. Same on maple, 20 Aug. From **M. F. Tiger**, Patchogue, N. Y. Young and adults of same on maple, 5 Oct. From **M. F. Adams**, Buffalo, N. Y.

Lecanium hesperidum Linn. on leaves of English laurel, 30 Sep., through state department of agriculture.

Brown apricot scale of California, *Lecanium armeniacum* Craw, on grape, 6 June. From **A. H. Hayes**, Erie county, N. Y.

Tulip-tree scale, *Lecanium tulipiferae* Cook, 11 Oct. From **Alfred Pell**, Highland Falls, N. Y.

Numerous examples of the New York plum scale, *Lecanium prunastri* Fonsc. on cherry trees, 31 Jan. From **James Hendrick**, Albany, N. Y. Same on *Ardisia crenulata*, 29 July. From **Chester Young**, Flushing, N. Y.

Lecanium cerasifex Fitch on oak, 29 July. From Geneva, N. Y., through state department of agriculture. Same on maple at Menands, 16 Sep. From **Chester Young**, nursery inspector.

Lecanium hemisphaericum Targ. on mistletoe, 9 Mar. From **D. S. Martin**, Columbia, S. C.

San José scale, *Aspidiotus perniciosus* Comst., 9 Ap. From **James B. Jessup**, Woodstown, N. J. Same badly infesting pear twigs and fruit, 9 July. From **H. A. Unger**, East Greenbush, N. Y. Same on pear, 29 July. From Flushing, N. Y. Same infesting several species of trees, 13 Aug. From Farley's, Cayuga county, N. Y. Same on pear, 29 Aug. From Geneva, N. Y. Same on pear, 16 Sep. From Troy, N. Y. Same on white lilac, 22 Sep. From Montrose, N. Y. From the last five localities through the state department of agriculture.

Numerous examples of *Aspidiotus ancylus* Putnam on currant, 21 May. From **C. H. Stuart**, Newark, N. Y. Taken at Palmyra, N. Y. Same on willow, 2 Aug. From Fredonia, N. Y. Same on maple, 2 Aug. From Far Rockaway, N. Y. Same on American elm, 2 Aug. From Brighton, N. Y. Same on *Prunus* and pear twigs, 8 Aug. From Geneva, N. Y. Same on apple, 29 Aug. From Penfield, N. Y. Same from Medina, N. Y., 16 Sep., all but first through state department of agriculture.

English walnut scale, *Aspidiotus juglans-regiae* Comst., on European mountain ash, 2 Aug. From Brighton, N. Y., through state department of agriculture.

Numerous examples of *Aspidiotus dictyospermi* Morgan on *Areca lutescens* in an Ohio greenhouse, 16 May. From **T. D. A. Cockerell**, Mesilla Park, New Mexico.

Apple-tree bark louse, *Mytilaspis pomorum* Bouché, on apple twigs, 5 Mar. From **G: W: Horton**, Brewster, N. Y. Same on apple, 17 Mar. From the **H. E. Hooker co.**, Rochester, N. Y. Numerous examples of same on apple twigs, 19 May. From **G: H. Brackenbury**, Auburn, N. Y. Same badly infesting twigs of privet and lilac, 29 July. From **Chester Young**, Flushing, N. Y.

Twig of apple infested with the scurfy bark louse, *Chionaspis furfurus* Fitch, 29 Aug. From Penfield, N. Y., through state department of agriculture.

Juniper scale, *Diaspis carueli* Targ., on irish juniper, 9 Sep. From Sing Sing, N. Y., through state department of agriculture.

Numerous examples of the rose scale, *Aulacaspis rosae* Sandberg, on black-cap raspberry vines, 11 Mar. From **H. G. Chatham**, Elkin, N. C.

Aulacaspis boisduvalii Sign., on an orchid, 14 Jan. From Mrs **E. C. Anthony**, Gouverneur, N. Y.

Parlatoria pergandii Comst. on orange, 9 Sep. From Sing Sing, N. Y., through state department of agriculture.

Orthoptera

White flower cricket, *Oecanthus niveus* De Geer, 9 Sep. From Mrs **E. B. Smith**, Coeymans, N. Y. The same on asparagus, 20 Aug. From **J. A. Otterson**, Berlin, Mass.

Small striped ground cricket, *Nemobius fasciatus* De Geer, 20 Aug. From **J. A. Otterson**, Berlin, Mass.

Xiphidium brevipenne Scudd., 9 Sep. From Mrs. **E. B. Smith**, Coeymans, N. Y.

Cone headed katydid, *Conocephalus ensiger* Harris, 23 July. From Mrs **H. Bull**, Albany, N. Y.

Eggs of a katydid *Microcentrum laurifolium* Linn., from belt of sewing machine, 10 Sep. From **W. A. Whitmore**, Marietta, Ga.

Katydid, *Amblycorypha oblongifolia* De Geer, 9 Sep. From Mrs **E. B. Smith**, Coeymans, N. Y.

Red-legged grasshopper, *Melanoplus femur-rubrum* De Geer. From Mrs **E. B. Smith**, Coeymans, N. Y.

Female and eggs of the walking stick, *Diapheromera femorata* Say, 9 Aug. From **A. C. Armstrong**, Amboy, N. Y.

Oriental cockroach, *Periplaneta orientalis* Linn., 19 May. From **S. C. Bradt**, Albany, N. Y. Same infested with a hair snake, *Gordius* sp., over 4 inches long, 9 Aug. From Mrs **E. L. Strong**, Ogdensburg, N. Y.

Odonata

Gomphus exilis Selys, 9 Sep. From Mrs **E. B. Smith**, Coeymans, N. Y.

Arachnida

Living female tarantula, *Eurypelma hentzii* Girard, and its cast skin, 10 Jan. From Dr **J. M. Bigelow**, Albany, N. Y.

Trombidium muscarum Riley on house fly, 29 July and 12 Oct. From **J. G. Linsley**, Oswego, N. Y.

Pear leaves infested with the pear blister mite, *Phytoptus pyri* Scheuten, 26 June. From **E. P. Wentworth**, Portland, Me.

Three examples of *Chernes ?sanborni* Hagen, from a fly, species not given, 25 July. From **G. B. Simpson**, Albany, N. Y. A specimen of the same on house fly, 12 Oct. From **J. G. Linsley**, Oswego, N. Y.

Myriapoda

Household centipede, *Scutigera forceps* Raf., 19 May. From **S. C. Bradt**, Albany, N. Y.

EXPLANATION OF PLATES

Plate 1. Sugar orchard of Ely Swart, near Arkville, Delaware co., showing extensive defoliation by the forest tent caterpillar.^a

Plate 2. Nearer view of a portion of the same.

Plate 3. Single tree on same place.

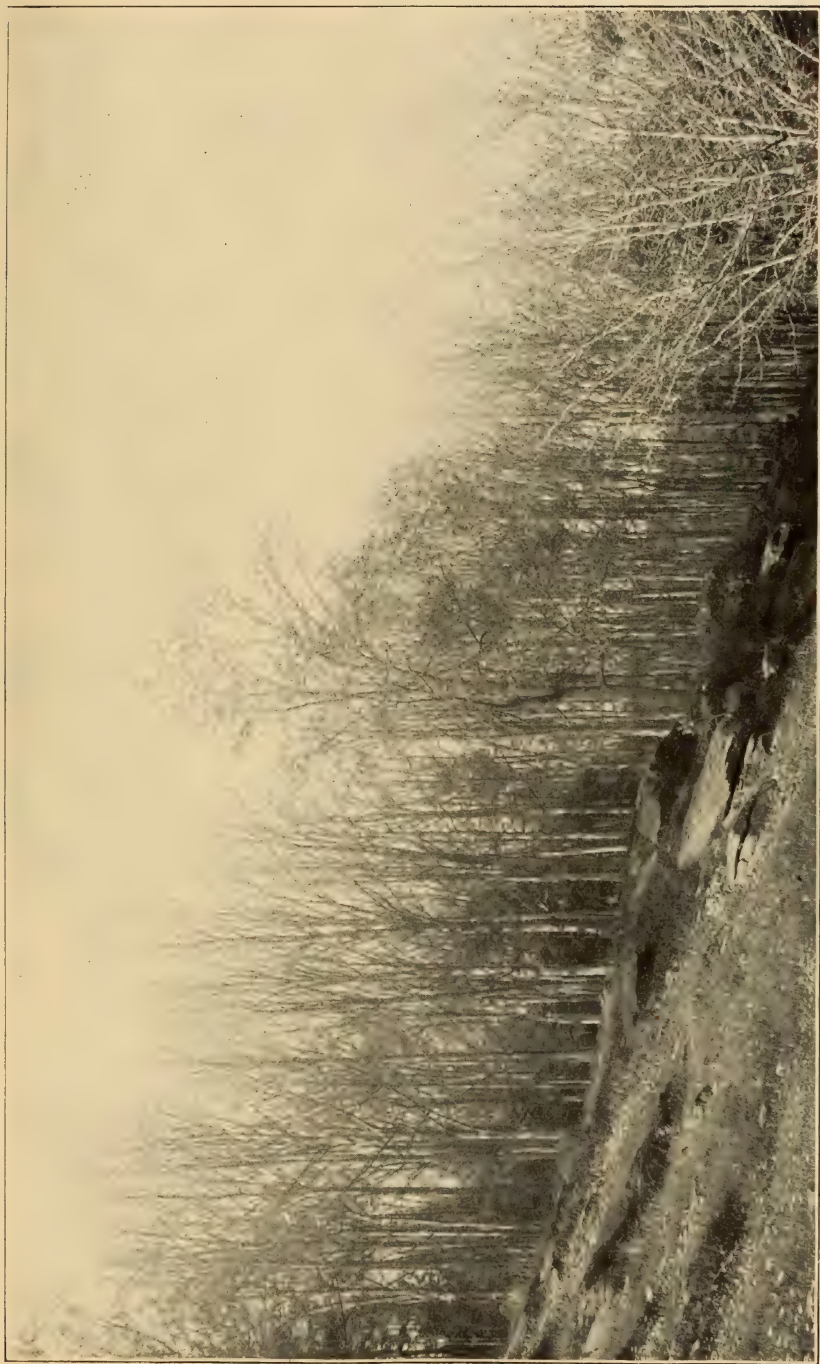
Plate 4. Maples and birches near Margaretville, Delaware co., showing work of same insect.

Plate 5. Larvae of *Mamestra picta* on portion of beet leaf.

Plate 6. *Eurypelma hentzii*. Fig. 1, dorsal aspect of cast skin: *a*, dorsum of cephalo-thorax; *b*, location of eyes; *c*, empty coxal cavities; *e*, loose skin of abdomen; *f*, palpi.

Plate 7. *Eurypelma hentzii*. Fig. 2, ventral aspect of cast skin: *d*, poison fangs; other lettering as in the preceding.

^a Plates 1-4 are from photographs taken by H. B. Ingram, of Kingston, N. Y., July 8, 1898.



Sugar orchard defoliated by forest tent caterpillars, Arkville, Delaware county.





Portion of sugar orchard defoliated by forest tent caterpillars, Arkville, Delaware county.



Maple defoliated by forest tent caterpillars.



Defoliated maples and birches, Margaretville, N. Y.



Zebra caterpillars.



Cast tarantula skin—dorsal aspect.



Cast tarantula skin—ventral aspect.

Plate 8



Fig. 7 *CLISIOCAMPA AMERICANA*, *a*, male; *b*, hermaphrodite; *c*, female (original).



Fig. 12 *XYLINA ANTENNATA* (original).



Fig. 14 Young of *LECANIUM TULIPIFERAE*, much enlarged (original).

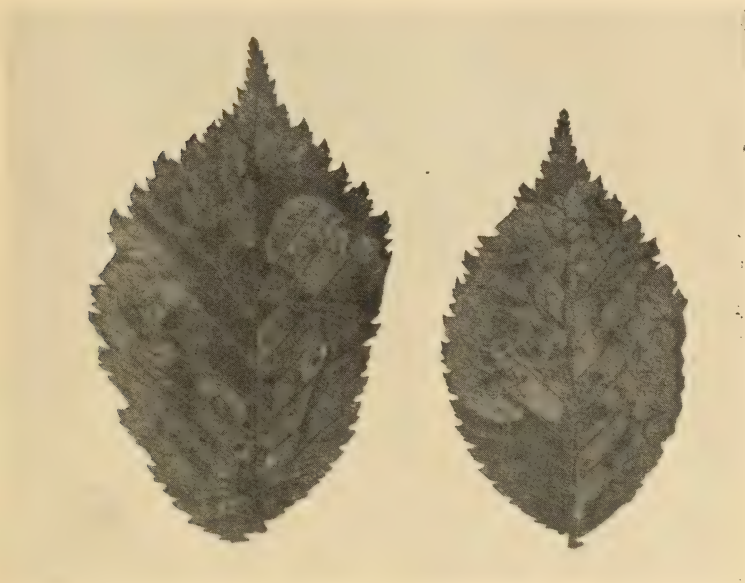


Fig. 17 Work of the elm-leaf miner (original).



Fig. 20 Young of *PULVINARIA INNUMERABILIS* on maple leaf (original).

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ERRATA

Page 168, line 3, for Dyar, read Dyar^a,

Page 173, line 3, for *Abbott* read *Abbot*.

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